Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

VOL. 71—No. 6. CHICAGO, SATURDAY, AUGUST 11, 1917. PAGE 213

Fundamental Features of a Sound Public Utility Bond

A Discussion of the Legal, Physical and Economic Considerations Which Affect the Security of a Public Utility Bond

By F. K. SHRADER

Halsey, Stuart & Company.

THE public utility business in this country, including street and electric railways, central stations, artificial gas plants, and telephone systems—but excluding water works properties, for the reason that comprehensive figures are not available—comprises a business of substantially one-half the proportions of the steam-railroad business, measured by the invested capital and gross earnings. In 1912, the date of the latest available United States census figures for the country as a whole, there was invested in the above mentioned four classes of public utilities over $8,700,000,000, and their combined gross earnings that year were in excess of $1,345,000,000. The growth in public utilities has been truly remarkable, invested capital, exclusive of telephones for which figures in 1902 are not available, increasing in ten-year period of 1902-1912 from $3,239,000,000 to $7,688,000,000, an increase of 137 per cent; gross earnings in the same period increased over $600,000,000, or 150 per cent and net earnings $243,000,000, or 165 per cent. These figures, the details of which are shown in Table I, indicate the scope of the public utility business and, in a general way, convey some idea of the economic necessity of following sound financial procedure in conducting their operations. The investment banker and the public utility operator, charged with the responsibility of financing and conducting a business of the proportions indicated, may very properly devote some serious thought to the questions involved in sound public utility finance. With this idea in mind I have endeavored to set down here in a brief manner some of the fundamentals met with in financing a public utility corporation.

The many considerations affecting the security of a public utility bond may be classified under three main headings: Legal, physical, and economic or business.

I shall not attempt to discuss at any great length the legal and physical features, but rather will limit my remarks on these two subjects to a brief enumeration of some of the principal points involved.

TABLE I.—SUMMARY STATEMENT STREET AND ELECTRIC RAILWAYS, CENTRAL ELECTRIC STATIONS, GAS PLANTS AND TELEPHONE SYSTEMS OF THE UNITED STATES, 1912, 1907, 1902.

(Compiled from U. S. Census Bureau Bulletins.)

	1912	1907.	1902.
Cost of construction, equipment and real estate:			
Street and electric railways	$4,596,563,292	$3,637,668,708	$2,167,634,077
Central electric stations	2,175,678,266	1,096,913,622	504,740,352
Gas plants	915,936,762	725,035,204	567,000,506
Total for three classes	$7,688,178,320	$5,459,617,534	$3,239,374,935
Telephone systems having an annual income of $5,000 or more	1,081,433,227	794,096,971	.....
Total for four classes	$8,769,611,547	$6,253,714,505	.....
Gross income:			
Street and electric railways	$ 621,535,884	$ 477,657,503	$ 276,643,526
Central electric stations	302,115,599	175,642,338	85,700,605
Gas plants	166,814,371	125,144,945	75,716,693
Total for three classes	$1,090,465,854	$ 778,444,786	438,060,824
Telephone systems having an annual income of $5,000 or more	255,081,234	176,700,408	.....
Total for four classes	$1,345,547,088	$ 955,145,194	.....
Net earnings:			
Street and electric railways	$ 202,061,105	$ 152,956,067	$ 95,331,070
Central electric stations	136,496,919	69,437,189	30,242,775
Gas plants	53,313,293	32,885,990	22,632,519
Total for three classes	$ 391,871,417	$ 255,279,246	$ 148,206,364
Telephone systems having an annual income of $5,000 or more	71,490,285 (a)	57,160,626 (a)	.....
Total for four classes	$ 463,361,702	$ 312,439,872	.....
Interest charges:			
Street and electric railways	$ 113,259,470	$ 81,771,266	$ 46,462,470
Central electric stations	48,302,900	27,991,762	12,623,545
Gas plants	Figures not available.		
Telephone systems having an annual income of $5,000 or more	20,163,960	15,935,395	.....
Dividends:			
Street and electric railways	$ 70,992,218	$ 54,485,274	$ 33,039,171
Central electric stations	34,580,872	19,300,572	6,189,837
Gas plants	Figures not available.		
Telephone systems having an annual income of $5,000 or more	34,120,809	23,448,212	.....
Units of business done:			
Street and electric railways—Total passengers carried	12,135,341,716	9,533,080,766	5,836,615,296
Central electric stations—K. W. H. output	11,532,963,006	5,862,276,737	2,507,051,115
Gas plants—Gas made, 1,000 cu. ft	150,835,793	112,549,979	67,093,553
Telephone systems—Estimated number of messages or talks	13,735,658,245	10,400,433,958	.....

(a) After depreciation charges.

Figures for gas plants are for years 1909, 1904 and 1899 respectively.

Under legal phases the following points would come up for consideration:

(1) Is the corporation properly and legally organized with the necessary charter rights to engage in the business for which it is formed?

(2) Does it possess the requisite franchise rights to enable it to freely and permanently conduct its business in the community it serves?

(3) Are the titles to its property good and free from attack?

(4) Are all its contracts and leases in valid form and do they impose any undue burdens upon the corporation?

(5) Is the bond issue secured by a validly authorized and properly executed and recorded mortgage, incorporating proper provisions for safeguarding the interests of the bondholder, and establishing the desired lien on the assets of the corporation?

(6) Are the bonds properly issued in compliance with the terms of the mortgage and any agreements supplemental thereto?

(7) Is the corporation subject to the jurisdiction of a public service commission or analogous body, and if so, to what extent may the commission regulate the rates, service and security issues of the corporation?

Under physical phases we should expect to have full and accurate knowledge on the following features:

(1) Is the property economically constructed and so located as to most advantageously serve its community?

(2) Is the equipment modern and of a character to adequately perform its functions?

(3) What is the value of the property?

(4) What is the physical condition of the property and what requirements must the corporation meet for its upkeep in the future; in other words, how, specifically, will the integrity of the investment be permanently maintained?

(5) What is the productive capacity of the plant in relation to present and probable future demands for adequate service, and with what facility may the plant be extended to meet these demands?

(6) What franchise or other legal obligations are imposed upon the corporation with reference to plant equipment or extensions?

Coming now to the economic or business phases, a field in which the investment banker is called upon to exercise the most unrelaxing care and mature judgment, we may briefly state as follows some of the more important considerations that must be analyzed and weighed in the selection of a sound public utility bond:

(1) Community served—Is it prosperous and growing and capable of supporting the service offered? Is the territory capable of development? What are the natural resources of the surrounding region? Are the industries of the community stable and firmly established? What facilities are present to induce growth in population?

(2) Character of Business Done—Is it dependent in any considerable degree upon one or a few industries? Is it solely one class of utility, i. e., gas, electric, street railway, telephone, water, or is it a combination of two or more of these classes?

(3) Earnings—What is the company's record of earnings over a period of years? Are they commensurate with the earnings of companies similarly situated? Do they produce an adequate, or excessive, return on the fair investment value of the property? Under what schedule of rates are they secured and are these rates fair?

(4) Capitalization—What is the financial structure of the corporation? Is it properly balanced to provide for the issuance and sale of the requisite junior securities? Will it stand the test of years of depression?

(5) Competition—What are the existing and potential possibilities of competition? Is the company fully protected by law or ordinance in this respect?

(6) Public Relations—What is the standing of the company and its officials in the community it serves?

(7) Management—Is the conduct of the company's affairs in the hands of men of intelligence,

integrity and responsibility? Are they fitted by past experience to successfully carry on the business?

Having stated in general terms the broad aspects of the subject, let us now examine with some degree of particularity a few of the more pronounced fundamentals.

To show in a concrete fashion the financial results obtainable from utility operation under varying assumed controlling factors, viz., the rate of return allowed on the total investment, the unit of investment required to produce a unit of income, and certain imposed restrictions in the issuance of securities, the figures in Table II were computed. Rates of return of 6, 7 and 8 per cent, all exclusive of any allowance for depreciation, were selected as practically covering the range of allowances fixed in cases coming before utility commissions; investment units of $4, $5, $6, $7 and $8, per $1 of gross income, also may be assumed to include all existing conditions in the utility field, with the possible exception of some water works and hydroelectric properties. The conditions chosen respecting the issuance of securities, designated in the table as A, B, and C, respectively, are, it is believed, fairly typical examples of restrictions imposed in public utility financing under present-day practice and present market conditions, condition A being rather lenient, condition B fairly conservative, and condition C imposing requirements met only by companies in first-class credit standing.

With a rate of return of only 6 per cent allowed the financial results obtained, according to the figures in this table, are apparently not sufficiently remunerative to permanently attract capital for the business under any of the assumed conditions of investment or issuance of securities. To permanently induce capital to enter the utility field, a rate per cent return for the stockholder of more than 4.17, 4.93, or even 5.54 per cent as obtained respectively under conditions A, B, and C must be shown. An indicated return for the stockholder of at least 10 per cent must be obtainable to attract the junior money necessary for the permanent development of utility properties, bearing in mind that some substantial part of the 10 per cent must be retained in the business in the shape of reserves, surplus, etc. Under a six per cent rate of return allowed on the total investment, to secure a 10 per cent return for the stockholder it would be necessary, as shown in the following table, to sell 5 per cent bonds, at par, to the extent of nearly 90 per cent of the value of the property, assuming an investment of $6 for each $1 of gross revenue produced. Furthermore, under these conditions, the ratio of net earnings to bond interest would be only 1.40, and it would be necessary to operate and maintain the property for 64 per cent of the gross revenue. Such financing is scarcely possible nowadays.

Investment	600
Gross	100
Operating	64
Net	36
Bond interest	26
Balance for stock	10
Per cent on stock	10
Operating ratio	64
Par value bonds	520
Proceeds at 100	520
Balance from stock	80
Par value at 80	100

Reverting to the figures in Table II it will be noted that not until we reach an 8 per cent return on the total investment is a return of 10 per cent or more obtained for the stockholder, and even then if the investment equals or exceeds $5 per dollar of gross it becomes doubtful if the indicated results can be obtained, by reason of the necessarily low operating ratio. For instance, if the investment reaches $6, as no doubt it already does in the case of many gas companies, it becomes necessary to operate on a ratio of

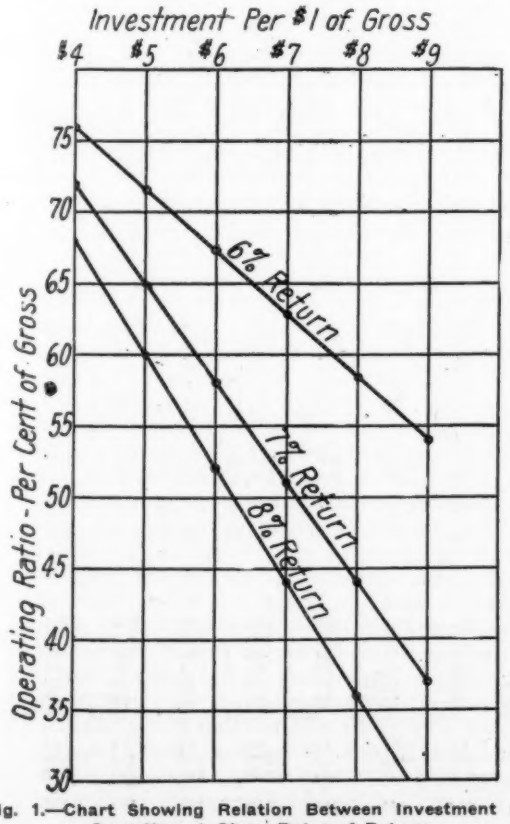


Fig. 1.—Chart Showing Relation Between Investment and Operation at Given Rates of Return.

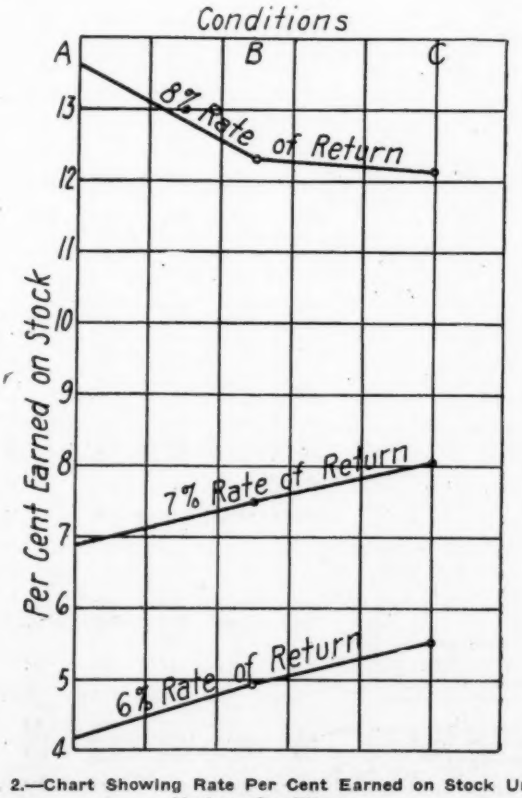


Fig. 2.—Chart Showing Rate Per Cent Earned on Stock Under Various Conditions.

52 per cent to obtain 12 per cent for the stockholder and surplus account.

To my mind perhaps the most striking feature of these figures is the fact that as the investment rises the operating ratio must diminish very rapidly, and this holds true both under a constant rate of return and, even to a greater extent, as the rate of return grows larger. For instance, with an investment of $4 per unit of gross revenue a return of 6 per cent can be realized with the property operated at 76 per cent, but for each additional dollar of investment it becomes necessary to reduce the operating ratio 6 per cent to realize the same rate of return, viz., 6 per cent. To secure a return of 7 per cent on the total investment each additional unit of investment calls for a reduction of 7 per cent in operation, and under an 8 per cent return a reduction of 8 per cent in the operating ratio. These figures bearing upon the relation between investment and operation are shown graphically in the chart in Fig. 1, in which there is included an ordinate for a $9 investment ratio, this being perhaps approximately the maximum investment now attained in any of the branches of utility operation.

Fig. 2 shows graphically the rate per cent earned on stock under the various conditions assumed in Table II.

There is another feature involved in the figures of Table II, which, while perhaps not so apparent, is nevertheless of equal, if not greater, importance, and that is the cost of money. Taking the bonds at the assumed rate of interest, 5 per cent, and further assuming a maturity of 30 years, we find the cost of the money invested in the enterprise to be as follows, the cost in the rate per cent per annum remaining constant under the various assumed relations of investment to gross earnings:

COST OF MONEY—PER CENT PER ANNUM.

	Rate of return		
	6 per cent.	7 per cent.	8 per cent.
Condition A	7.05	6.90	6.73
Condition B	6.68	6.55	6.41
Condition C	6.32	6.20	6.08

These figures do not include any of the incidental costs of raising money, such as preparation of engineering and financial reports, appearances before com-

TABLE III.—SHOWING RATES OF INTEREST BORNE BY MUNICIPAL BONDS SOLD IN THE UNITED STATES —PERCENTAGES OF VARIOUS RATES OF INTEREST TO TOTAL SALES 1901-1915.

(Compiled from reports issued by the Commercial and Financial Chronicle.)

Calendar year.	Rates of interest — 3½ per cent or less.	4½ per cent or more.	Remainder.*
1901	60.83	13.13	26.04
1902	59.94	11.33	28.73
1903	47.38	17.85	34.77
1904	54.13	14.26	31.61
1905	47.24	20.85	31.91
1906	17.92	19.42	62.66
1907	7.44	45.42	47.14
1908	5.91	50.95	43.14
1909	11.38	37.99	50.63
1910	10.02	40.46	49.52
1911	2.14	46.21	51.65
1912	2.11	48.27	49.62
1913	5.69	67.07	27.24
1914	.05	65.39	34.56
1915	.01	71.13	28.86

* Includes 4 per cent, 4¼ per cent, and unknown and unusual.

TABLE II

	6 per cent return. Investment in dollars per dollar of gross					7 per cent return. Investment in dollars per dollar of gross					8 per cent return. Investment in dollars per dollar of gross				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
A. Ratio net earnings to bond interest...1½															
5% bonds sold at..80															
Stock sold at.....75															
Investment 400	500	600	700	800	400	500	600	700	800	400	500	600	700	800	
Gross 100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Operating 76	70	64	58	52	72	65	58	51	44	68	60	52	44	36	
Net 24	30	36	42	48	28	35	42	49	56	32	40	48	56	64	
Bond interest 16	20	24	28	32	18.67	23.33	28	32.67	37.33	21.33	26.67	32	37.33	42.67	
Balance for stock..... 8	10	12	14	16	9.33	11.67	14	16.33	18.67	10.67	13.33	16	18.67	21.33	
Per cent on stock..... 4.17	4.17	4.17	4.17	4.17	6.91	6.91	6.91	6.91	6.91	13.64	13.64	13.64	13.64	13.64	
Operating ratio, per cent 76	70	64	58	52	72	65	58	51	44	68	60	52	44	36	
Par value 5% bonds.....320	400	480	560	640	373.33	466.66	560	653.40	746.60	426.60	533.40	640	746.60	853.40	
Proceeds at 80.....256	320	384	448	512	298.66	373.33	448	522.72	597.28	341.28	426.72	512	597.28	682.72	
Balance of cash to be raised from stock...144	180	216	252	288	101.34	126.67	152	177.28	202.72	58.72	73.28	88	102.72	117.28	
Par value stock required at 75 192	240	288	336	284	135.12	168.90	203	236.37	270.29	78.29	97.71	117.33	136.96	156.37	
B. Ratio net earnings to bond interest...1¾															
5% bonds sold at..85															
Stock sold at.....80															
Investment 400	500	600	700	800	400	500	600	700	800	400	500	600	700	800	
Gross 100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Operating 76	70	64	58	52	72	65	58	51	44	68	60	52	44	36	
Net 24	30	36	42	48	28	35	42	49	56	32	40	48	56	64	
Bond interest 13.71	17.14	20.57	24	27.43	16	20	24	28	32	18.29	22.86	27.43	32	36.57	
Balance for stock..... 10.29	12.86	15.43	18	20.57	12	15	18	21	24	13.71	17.14	20.57	24	27.43	
Per cent on stock..... 4.93	4.93	4.93	4.93	4.93	7.50	7.50	7.50	7.50	7.50	12.31	12.31	12.31	12.31	12.31	
Operating ratio, per cent 76	70	64	58	52	72	65	58	51	44	68	60	52	44	36	
Par value 5% bonds.....274.20	342.80	411.40	480	548.60	320	400	480	560	640	365.80	457.20	548.60	640	731.40	
Proceeds at 85.....233.07	291.38	349.69	408	466.31	272	340	408	476	544	310.93	388.62	466.31	544	621.69	
Balance of cash to be raised from stock...166.93	208.62	250.31	292	333.69	128	160	192	224	256	89.07	111.38	133.69	156	178.31	
Par value stock required at 80 .....208.66	260.77	312.89	365	417.11	160	200	240	280	320	111.34	139.22	167.11	195	222.89	
C. Ratio net earnings to bond interest.....2															
5% bonds sold at..90															
Stock sold at.....85															
Investment 400	500	600	700	800	400	500	600	700	800	400	500	600	700	800	
Gross 100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Operating 76	70	64	58	52	72	65	58	51	44	68	66	52	44	36	
Net 24	30	36	42	48	28	35	42	49	56	32	40	48	56	64	
Bond interest 12	15	18	21	24	14	17.50	21	24.50	28	16	20	24	28	32	
Balance for stock..... 12	15	18	21	24	14	17.50	21	24.50	28	16	20	24	28	32	
Per cent on stock..... 5.54	5.54	5.54	5.54	5.54	8.04	8.04	8.04	8.04	8.04	12.14	12.14	12.14	12.14	12.14	
Operating ratio, per cent 76	70	64	58	52	72	65	58	51	44	68	60	52	44	36	
Par value 5% bonds.....240	300	360	420	480	280	350	420	490	560	320	400	480	560	640	
Proceeds at 90.....216	270	324	378	432	252	315	378	441	504	288	360	432	504	576	
Balance of cash to be raised from stock...184	230	276	322	368	148	185	222	259	296	112	140	168	196	224	
Par value stock required at 85 .....216.47	270.59	324.71	378.82	432.94	174.12	217.65	261.17	304.71	348.34	131.76	164.71	197.65	230.59	263.53	

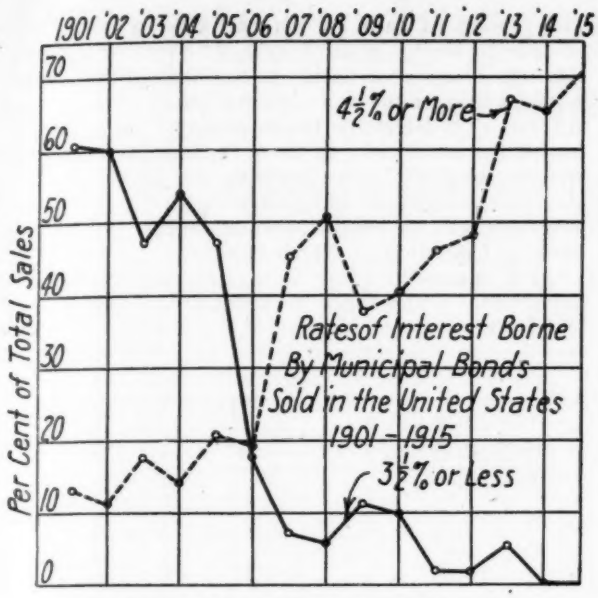


Fig. 3.—Rates of Interest Earned by Municipal Bonds.

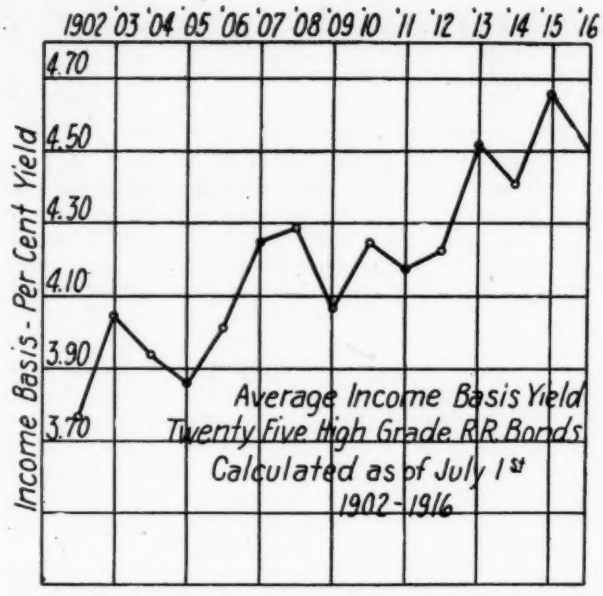

1902 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16
4.70
4.50
4.30
4.10
3.90
3.70
Income Basis - Per Cent Yield
Average Income Basis Yield Twenty Five High Grade RR Bonds Calculated as of July 1st 1902 - 1916

Fig. 4.—Average Yield from Railroad Bonds.

missions and other legal expenses, preparation of securities, fees and expenses of trustees, etc. Even excluding these indirect costs it will be noted from the foregoing figures that under Condition A and a rate of return of, say, 7 per cent for every dollar put into its business a utility corporation must pay out in interest 6.9 cents. Now, if it requires an investment of, say, $5 to produce a dollar of income, you find that 34.5 cents of it goes for interest, leaving but 65.5 cents with which to operate and maintain the property. If the business calls for an investment of $6 for every dollar of gross, interest charges absorb 41.4 cents of the dollar, thus necessitating a reduction in operation to 58.6 cents. If through better credit a company can finance itself under Condition C and is fortunate enough to earn, or be permitted to earn if it has demonstrated its capacity to do so, a return of 8 per cent on its investment we find that on a basis of $5 of investment per $1 of gross, only 30.4 cents are taken up in interest, leaving 69.6 cents for operation, and on a basis of $6 to $1 but 36.48 cents go to interest, still leaving 63.52 cents for operation and maintenance.

These illustrations can but impress one with the fact that the cost of money is one of the most inportant, perhaps even the controlling, consideration in utility operation. Certainly it so strikes me and some figures which I have compiled to show the trend of the cost of money in the past few years may be of interest. Unfortunately there are not available any comprehensive figures relating directly to public utility bonds, but in lieu thereof I have selected for the purpose of showing the trend in money rates two of the very highest forms of credit instruments current in the investment markets of this country, viz., municipal bonds, and selected high-grade railroad bonds.

If you will examine the figures in Table III showing the rates of interest borne by all municipal bonds sold in the United States in the 15 years 1901-1915, inclusive, you cannot fail to be impressed with the striking illustration of the increasing cost of money over the period therein included. In 1901, for instance, over 60 per cent of all municipal bonds sold bore interest at a rate of 3½ per cent or less and only slightly over 13 per cent of the bonds sold bore 4½ per cent or more.

The respective percentages to total sales of these two classes, 3½ per cent or less, and 4½ per cent or more, are shown graphically in Fig. 3.

To fully appreciate the significance of these figures, they should be applied to the bonds sold in 1915, which amounted to $496,498,057 par value. Omitting from the calculation the 4 per cent, 4¼ per cent and unknown and unusual sales, the combined percentages of which are practically the same at the two periods, the annual interest on sales of 1915, applying the 1901 conditions and the 1915 conditions, works out as follows:

					1915. Annual interest.
0.01%	of $496,498,057,	$ 49,649	@	3½%=	$ 1,737
71.13%	of 496,498,057,	353,159,067	@	4½%=	15,892,158
71.14%	of $496,498,057,	$353,208.716			$15,893,895

					1901. Annual interest.
60.83%	of $496,498,057,	$302,019,768	@	3½%=	$10,570,691
13.13%	of 496,498,057,	65,190,194	@	4½%=	2,933,558
73.96%	of $496,498,057,	$367,209,962			$13,504,249
Excess annual interest charges 1915 over 1901					$ 2,389,646

Thus we find that the combined *annual* interest charges on municipal bonds sold in the United States in 1915 are not less than $2,389,646 higher than they would have been had the bonds been issued at rates prevailing in 1901.

A marked example of similar tendencies is to be found in the case of railroad bonds. For this purpose I have selected 25 high-grade listed railroad bonds, including such issues as Atchison General 4's, B. & O. Prior Lien 3½'s, Chesapeake & Ohio First 5's, L. & N. Unified 4's, Reading General 4's, Union Pacific Land Grant 4's and similar issues, and calculated the average income basis yield of these twenty-five issues as of July 1 in each of the years 1901 to 1916, inclusive. The results appear as follows:

		Average income basis yield, per cent.
July 1,	1901	3.83
	1902	3.77
	1903	4.05
	1904	3.94
	1905	3.86
	1906	4.02
	1907	4.25
	1908	4.29
	1909	4.07

1910	4.25
1911	4.18
1912	4.23
1913	4.52
1914	4.41
1915	4.66
1916	4.51

These averages are plotted in Fig. 4.

You will note an increase in the income basis from an average of 3.83 per cent in 1901 to an average of 4.51 per cent in 1916, an increase in per cent yield of 0.68 per cent. Now these figures reduced to dollars and cents are not without significance. They mean simply, that, based upon the average of 25 high credit companies, a railroad corporation pays now $4.51 for every $100 of capital raised through the sale of bonds, while in 1901 it paid only $3.83. On a capital issue of, say, $10,000,000 the cost in annual interest charges to the corporation would now amount to $451,000 against $383,000 under conditions existing in 1901. This is an increase in annual interest charges of $68,000, which in the life of a 50-year bond issue would amount to the respectable sum of $3,400,000, or 34 per cent of the original capital raised.

These two illustrations show in a fairly definite manner what the tendency has been with respect to the cost of money in the past 15 years. With conditions as they exist to-day there is scant reason to expect anything but a continued increase in the cost of capital the world over.

TABLE IV.—SHOWING EQUITY REPRESENTED BY EXCESS COST OF PROPERTY OVER BONDS ISSUED BASED UPON THE ISSUANCE OF $100,000 PAR VALUE OF BONDS EACH YEAR..

At the end of respective years.	Bonds issued at various percentages of cost of property. 70	75	80	85	90
1st year	42,857	33,333	25,000	17,647	11,111
2d year	85,714	66,667	50,000	35,294	22,222
3d year	128,571	100,000	75,000	52,941	33,333
4th year	171,428	133,333	100,000	70,588	44,444
5th year	214,285	166,667	125,000	88,235	55,556
6th year	257,142	200,000	150,000	105,882	66,667
7th year	299,999	233,333	175,000	123,529	77,778
8th year	342,856	266,667	200,000	141,176	88,889
9th year	385,713	300,000	225,000	158,824	100,000
10th year	428,571	333,333	250,000	176,470	111,111
11th year	471,428	366,667	275,000	194,117	122,222
12th year	514,286	400,000	300,000	211,761	133,333
13th year	557,143	433,333	325,000	229,412	144,444
14th year	600,000	466,667	350,000	247,059	155,556
15th year	642,857	500,000	375,000	264,706	166,667
16th year	685,714	533,333	400,000	282,353	177,778
17th year	728,571	566,667	425,000	300,000	188,889
18th year	771,429	600,000	450,000	317,647	200,000
19th year	814,286	633,333	475,000	335,294	211,111
20th year	857,143	666,667	500,000	352,941	222,222
21st year	900,000	700,000	525,000	370,588	233,333
22d year	942,857	733,333	550,000	388,235	244,444
23d year	985,714	766,667	575,000	405,882	255,556
24th year	1,028,571	800,000	600,000	423,529	266,667
25th year	1,071,429	833,333	625,000	441,176	277,778

Assurance of income depends, of course, upon the ability of the corporation to promptly meet its interest obligations. With a view to safeguarding this feature it is customary to provide in the mortgage that no bonds may be issued by the corporation unless its net earnings for the preceding year are equal to a certain amount in excess of the annual interest requirements. The prescribed ratio of net earnings to interest requirements varies from 1 to 2, or over. Frequently also the issuance of bonds is conditioned upon gross earnings being equal to a certain number of times bond interest. To determine the measure of protection afforded the bondholder by these restrictions as to gross and net earnings I have made up the figures in Table V. Four conditions, designated A, B, C and D, have been assumed, A being rather stringent, and ranging down to Condition D, which is loose.

The figures in Table V require little explanation, particularly when taken in conjunction with Fig. 5, which shows in graphical form the principal facts adduced. As the ratio of gross earnings to interest charges diminishes, the ratio of bonds to gross earnings correspondingly increases. With the specification that gross earnings shall equal six times bond interest the amount of bonds (at 5 per cent) outstanding would be only 3.5 times gross earnings, while under condition D, with the specification that gross shall equal only three times interest charges, the amount of bonds becomes 6⅔ times gross; in which latter case it would be necessary to operate the property at 58⅓ per cent, and only 8⅓ per cent of gross could be lost and interest charges still be met.

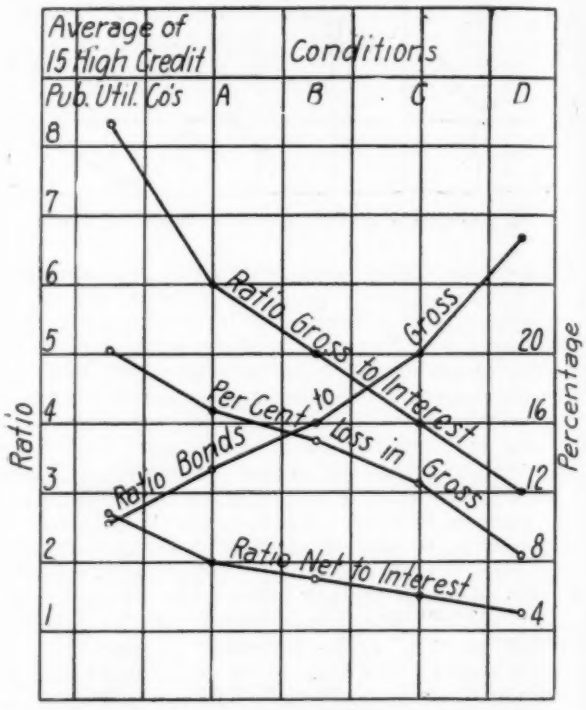


Fig. 5.—Relation Between Earnings and Indebtedness Under Various Conditions.

TABLE V.

	A Assume: Gross 6 times int. Net 2 times int. Amount of bonds would then be (at 5%) 3½ times gross.	B Assume: Gross 5 times int. Net 1¾ times int. Amount of bonds would then be (at 5%) 4 times gross.	C Assume: Gross 4 times int. Net 1½ times int. Amount of bonds would then be (at 5%) 5 times gross.	D Assume: Gross 3 times int. Net 1¼ times int. Amount of bonds would then be (at 5%) 6⅔ times gross.
Gross	600	500	400	300
Operating	400	325	250	175
Net	200	175	150	125
Bond interest	100	100	100	100
Balance	100	75	50	25
Operating ratio—% of gross.	66⅔	65	62½	58⅓
Amount gross may be reduced without reducing operating expenses and still meet interest charges	100	75	50	25
Per cent	16⅔	15	12½	8⅓
Operating ratio would then be	80	76½	71½	63½

Present Conditions in Electrical Security Market

Prices Are Lowest in Years Although Real Intrinsic Value of Properties Is Steadily Increasing

By W. H. HODGE

H. M. Byllesby & Company.

ALL THINGS considered, the present is exceptionally advantageous to the investor in electrical securities. Bargain opportunities in high-grade issues challenge his good judgment and faith in his country. Resolute action based on farsighted analysis will assuredly bring its customary reward.

The same opportunities open to the general investor should appeal with exceptional force to men associated with the electrical industry, who will quickly realize the situation if they take the time necessary for a careful survey of broad general conditions and the specific conditions immediately affecting the electric light and power business.

Since the declaration of war by the United States the normal investment market has been stagnant, due to the natural hesitancy arising from a new and unfamiliar status of all public and private affairs. The organization of the country for war, the financing of this all-important enterprise, the problems of taxation necessarily following and innumerable legislative innovations, have caused a feeling of uncertainty producing a consequent shrinkage in the current demand for investment securities.

While waiting for the government to plot a definite economic course, security prices have quite naturally declined until at present they have found levels not far from the lowest records in years. Many of the securities so affected, far from losing in real intrinsic value, have steadily enhanced in genuine value, based upon increased worth of physical properties and advancing earnings.

In the public utility investment market unquestionably an apprehension has prevailed that the high prices of fuel, operating supplies and construction materials militated against satisfactory net earnings. It has been argued that the difficulties of charging higher rates for utility service would prevent such companies from increasing revenues in proportion to increasing expenses, and that the difference necessarily would affect the surplus.

Although a great many electric companies operate with water power, and many more use natural gas fuel at fixed prices, no one is disposed to minimize the seriousness of the fuel situation to those plants dependent upon coal. The operating expenses of all utilities have mounted, but on the other hand vastly increased demands for their service and a variety of modifying factors combine to make the outlook as a whole anything but discouraging.

Electric service companies are accustomed to restricted profits. They have operated under state and municipal regulation for years. Their profits have been closely gauged upon actual invested values, and exorbitant or excessive profits have been out of the question. On the other hand, the acknowledged stability of this particular industry and the constantly growing demand for the services rendered have placed their securities on the firmest basis.

Therefore, the proposed "excess profits" and special "war profits" taxes will have little or no bearing upon central-station earnings. Very few, if any, companies will be affected by such taxes. A tax upon the use of electric light and power, of course, will tend to promote economy upon the part of customers but it is difficult to conceive how these individual economies will seriously jeopardize revenues, because so large a proportion of central-station income is now derived from the sale of electric energy for industrial purposes—power and heating.

On the other hand, the activities of national and state authorities in limiting the prices of coal, steel, copper and other commodities should work directly in favor of the electrical industry. It is probable that the maximum prices which electric companies have had to pay for materials and supplies have been reached, and that from now on these expenses will decline rather than advance.

The service rendered by central stations, always vital to public welfare, are doubly so at present when multitudes of mills and factories engaged in war production depend upon the electric companies for existing and future power requirements. Aside from war production the electric companies are inextricably bound up with functions involving public health, safety

LIST OF CHICAGO SECURITIES COMPILED TO SHOW PRESENT TENDENCIES.

Company and bonds—	Interest.	Due.	Amount outstanding.	High Year.	High Price.	High Yield.	Low Year.	Low Price.	Low Yield.	Present Price.	Present Yield.	Net decline Points.	Net decline Amount.
Chi. City & Con. Ry. col. trust.	5%	1927	$21,561,000	1912	91⅝	5.78%	1917	64	11.00%		11.00%	27⅝	5,956,226
Chi. City Ry. Co. 1st mtg.....	5	1927	33,900,000	1907	105	4.60	1917	92	6.07	92	6.07	13	4,407,000
Chicago Rys. Co. 1st mtg.....	5	1927	55,681,000	1909	102¾	4.70	1917	92	6.07	94	5.80	8¾	4,872,067
Chicago Rys. Co., series A.....	5	1927	17,403,800	1910	98	5.20	1917	82	7.60	82	7.60	16	2,784,608
Chicago Rys. Co., series B.....	5	1927	17,164,475	1910	95⅝	5.37	1917	66	10.75	66	10.55	29⅜	5,032,055
Chicago Rys. Co., series C	5	1927	1,144,336	1916	96½	5.35	1917	95	5.70	95½	5.60	1	11,443
Chicago Rys. Co. pur. money...	5	1927	4,073,000	1912	85	6.75	1917	58	12.00	58	12.00	27	1,099,710
Chicago Rys. Co. income	4	1927	2,500,000	1912	60	8.75	1917	39	14.75	39	14.75	21	523,000
Chicago Telephone Co. 1st mtg.	5	1923	18,998,000	1909	103⅞	4.60	1913	99⅜	5.06	99⅞	5.02	4	759,920
Commonw. Edison Co. 1st mtg..	5	1943	34,631,000	1912	103¾	4.70	1914	98⅝	5.12	99⅝	5.03	4½	1,428,529
Lake St. Elev. R. R. 1st mtg...	5	1928	4,432,000	1902	103	4.80	1917	55	12.25	55	12.25	48	2,127,160
Metro. West Side El. 1st mtg...	4	1938	10,000,000	1902	102	3.80	1917	63¼	7.50	63¼	7.50	38¾	3,875,000
Metro. West Side El. ext. mtg..	4	1938	5,000,000	1902	99⅞	4.01	1917	63	7.55	63	7.55	36⅞	1,843,750
Peoples Gas Lt. & C. Co. refdg.	5	1947	20,554,000	1908	104	4.80	1917	94	5.40	94	5.40	10	2,055,400
Pub. Ser. Co. of N. Ill. 1st & ref.	5	1956	15,041,000	1912	100	5.00	1915	87¾	5.78	88⅞	5.68	11⅛	1,673,311
South Side Elev. R. R. 1st mtg.	4½	1924	8,000,000	1904	105⅛	4.10	1917	84	7.52	84	7.52	21⅛	1,690,000

and commercial activity. In these capacities electric companies are bound to receive the recognition in special war legislation which their highly essential character obviously requires.

Never before has the electrical industry been called upon for greater service to meet industrial demands, particularly for power for existing factories, enlarged factory requirements, new establishments and overtime production. Part of this business is being taken on with little new investment in lines and generating capacity. Much of it, however, necessitates the investment of new capital and the investor in public utility securities clearly performs a patriotic service as well as one to his own financial welfare.

A striking table showing the bargain prices prevailing in utility securities at present was recently prepared in the bond department of H. M. Byllesby & Company. This table, which is given below, gives the last available net earnings, present market prices of bonds and the yield to the investor of four good-sized power companies compared with similar statistics one year ago. It will be noted that whereas the net earnings show decided increases, the bond prices are in every case materially lower and the yield to the investor correspondingly higher.

Security.	Net earnings.	Market price.	Yield to investor. Per cent.
Northern States Power 5s, 1941—			
June 30, 1916	$3,132,177	96½	5.25
June 30, 1917	3,498,559	93½	5.50
Western States 5s, 1941—			
June 30, 1916	582,101	93	5.50
June 30, 1917	617,348	89½	5.80
Appalachian Power 5s, 1941—			
June 30, 1916	399,843	82	6.45
June 30, 1917	481,765	79½	6.75
Oklahoma Gas & Electric 5s, 1929—			
June 30, 1916	796,772	98	5.25
June 30, 1917	876,637	93½	5.75

SALE OF UTILITY STOCK TO CUSTOMERS WINS APPROVAL.

Action of Oklahoma Gas & Electric Company Subject of Commendatory Editorial Comment.

The policy of a number of utilities under the management of H. M. Byllesby & Company of offering common stock to its customers on easy terms has been so successful that it is being extended to all of the company's properties. Recently the Oklahoma Gas & Electric Company, serving Oklahoma City, adopted the plan and the following reproduction of an editorial which was published in a recent issue of the *Daily Oklahoman*, is indicative of the approval with which the plan has met.

"The Oklahoma Gas and Electric Company is proposing that its customers become shareholders. It is offering its preferred stock to customers who can purchase it either for cash or on monthly installments. This plan opens the way to the man of limited means as well as to the big investor. It therefore commends itself to favorable consideration.

"The individual, of course, must decide for himself whether he wants to put his money into this project. The plan, itself, however, is interesting and, without hesitancy, may be termed a new step in the evolution of public utility finance, as well as an advance in public utility policy. It is a far cry, indeed, this proposal to take the public into partnership, from the early day methods of financing public utilities—the old practice of fantastic valuations, of watered stock, of promotion participations, of city hall corruption, and all the rest of it. 'The world do move.'

"It is manifest that if this plan is to come into the very flower of success the majority of the company's customers must be stockholders. It will take time to do that and along with time it will take business capacity and fairness on the part of the company. But assuming that it has been done, that the majority of us here in Oklahoma City have become stockholders in this company, what is the situation? Clearly, isn't it this? There will then be a real, substantial, community of interest between the public and this public utility company. The majority as shareholders can and will protect their business from any unfair assaults. On the other hand, they will still remain consumers of gas and electricity and will be in as good a position as ever, if not better, to protect themselves against poor service or excessive rates.

"Another result of this plan, assuming it has been carried out, is this: We shall have most of the advantages of municipal ownership, with very few of its disadvantages. The company will still remain a privately owned concern. It will have all the skill, experience and efficiency of private ownership in its management. Its payroll will not be cluttered up with the names of men whose only claim on the job is that they control so many votes in their precincts. Ability to deliver the goods will be the only tenure of a job.

"There can be no question in anyone's mind that public utilities ought to be publicly owned. Moreover, the ownership should be as largely local as possible. To digress for a minute, some of the most profound students of the 'railroad situation' hold that the quickest solution of the transportation problem will come by local ownership, that is, by having the stock of the railroad held in part by the people along the line. The attitude of any man toward a company in which he owns stock is necessarily different from his attitude toward a company in which he doesn't hold stock. In the latter case, it is the other fellow's business. In the former it is our own. And we all want our own enterprise to succeed, we want it to have a fair deal.

"The plan proposed by the local company is being tried out in a number of other cities. The Oklahoman cannot say with what success. But we believe the idea is sound. It roots down into the common human nature of us all. It is a move in the direction of better service by the public utility company and a better relationship between the company and the public.

"The essence of it, after all, is profit-sharing. That way lies progress."

Electrification and Extension of Salt Air Beach Line.

The electrification of the Salt Lake City-Salt Air railroad is in progress. The line runs from Salt Lake City, Utah, to Salt Air bathing beach, a distance of 18 miles. The road is to be extended from Salt Air to Garfield, a great ore-milling and smelting center, 30 miles from Salt Lake City, and the road will then not be confined to tourist traffic, but will be operated as a regular electric interurban line. Electrical equipment is being shipped in and poles are being erected. New electric passenger cars are to be built after designs by H. A. Strauss, consulting engineer, Chicago. These cars will be of steel construction, and equipped with 500-horsepower electric motors, and electro-puenmatic control apparatus. Special diffused lighting by means of ground glass globes in the ceiling is to be provided.

Safety of Public Utility Securities Not Affected by War

Interviews with Henry Hine, J. G. White, W. S. Barstow and Henry L. Doherty Indicate Value of Electrical Securities Firmly Established and Bound to Increase

SINCE the present market prices on electrical securities are the lowest in years, there has been some question as to whether this was due to high fuel and labor costs, with corresponding decrease in earnings or whether electrical securities were simply reflecting general market conditions. To obtain an authoritative discussion of this question, several of the leading public utility financiers and executives were approached and the appended interviews give every assurance that the safety of electrical securities has in no wise been affected.

Statement from Henry Hine, of Bonbright & Company, Inc., New York.

THE conditions affecting the securities of public utility companies, particularly those supplying electricity and gas, present an unusual combination of factors. The companies at present enjoy an extraordinary demand for their services, arising in great part from the increased requirements of manufacturers for electrical power. Many industries, by reason of the necessity of enlarging their facilities to take care of the great volume of business offered, have made additional demands for power, and other industries, which formerly met their power requirements by the operation of their own steam plants, have found the continued operation of their plants under present high costs of fuel prohibitive, and have consequently brought new business to the public utility companies. In fact, the utilities are in many instances unable to supply the full demand and can within reason, therefore, dictate the terms governing the furnishing of electricity. Long-term contracts are being made with favorable provisions regarding the price received for current and guarantees as to continuance of service. The increased revenue from this new business is rapidly offsetting the higher costs which those companies requiring coal and oil for their generating stations have encountered.

Another source of higher cost of production, namely, the necessity of operating partially abandoned, inefficient plants to meet the greatly increased demand for power is being met by the construction of additional units and distribution lines.

The increase in gross business of public utilities over 1916, a year which showed in many cases record earnings, has been widespread, as is indicated by the returns of the following representative companies:

Twelve Months Ended June 30.	1917.	1916.	% Inc.
Detroit Edison Company	$11,214,030	$8,879,460	26.2
Montana Power Company	6,819,362*	4,992,406*	36.6
Northern States Power Company	6,508,676*	5,546,573*	17.4
Tennessee Railway, Light & Power Company	5,051,124	4,210,537	20.0
Western Power Corporation	3,895,221	3,449,011	12.9

*Year ended May 31.

The conditions which are responsible for the present prosperity of the utility companies have a further influence on their securities. The great volume of business offered the industries of the country, necessitating large plant extensions, results in an increased demand for capital with which to make the required additions. This has a direct bearing on the security market in that as the demand for capital for many and varied industries is increasing at a rate greater than its supply, a decreased demand for securities results, and, as the market price of securities is determined in the first instance by the relation between the supply of funds and the amount of securities offered for sale, a depreciation in the market prices for public utility securities naturally results.

While, on the one hand, increased volume of business, undertaken at favorable terms, places the public utility companies in a particularly strong position and thereby enhances the investment value of their securities, on the other hand, conditions brought about by the general industrial activity of the country result in a general market situation which affords the investor many attractive bargains in public utility securities at the present time.

Statement from J. G. White, President, J. G. White & Company, New York.

NORMALLY, the desirability of any securities from the investment standpoint depends primarily on the safety of the capital invested and adequate assurance of satisfactory interest or dividend returns.

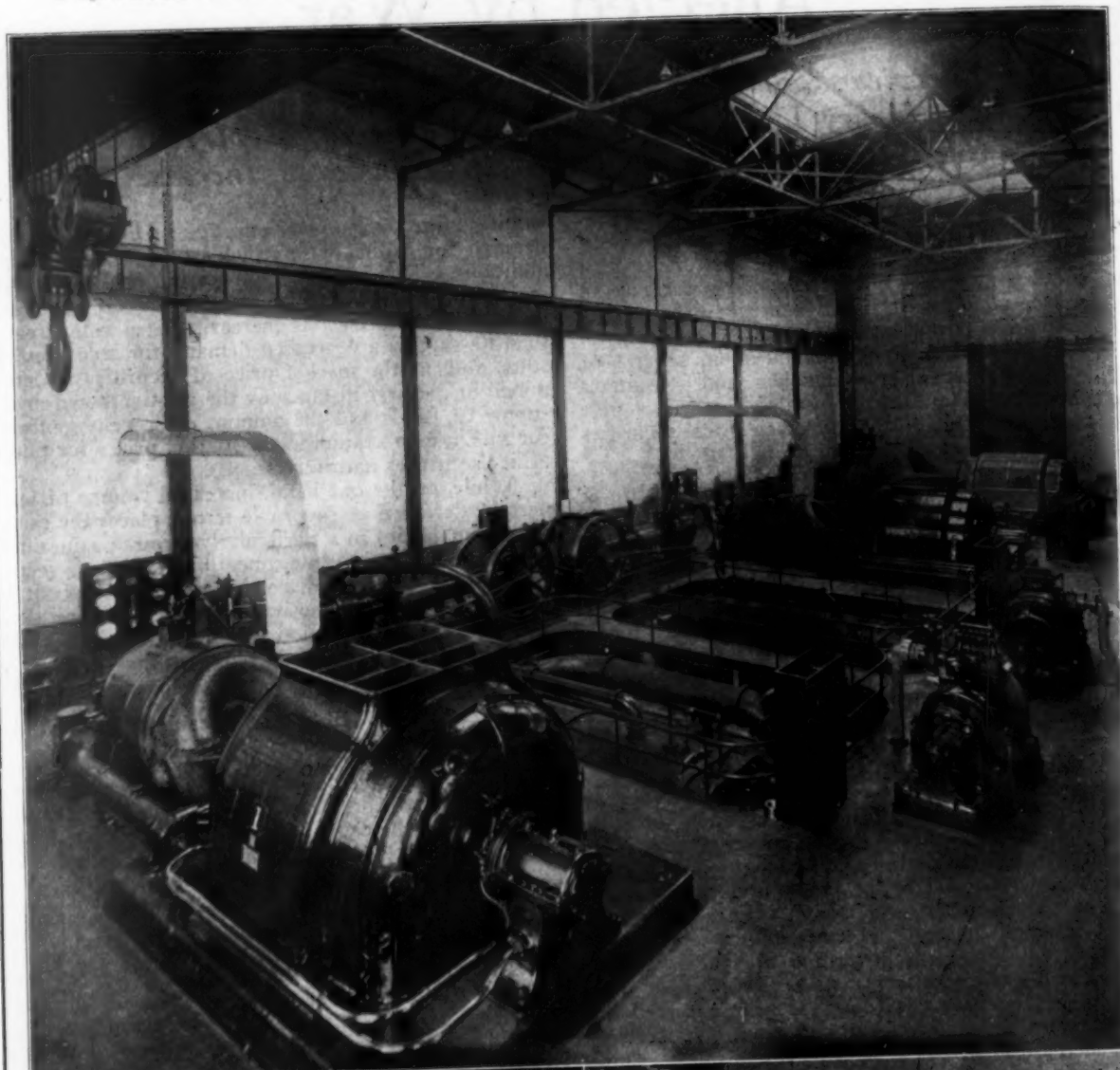
In many lines of industry the principal fear for the future comes from the probability of new competition in the hands of inexperienced people. In those states which have established public utility commissions this factor is largely eliminated. So many state commissions have pronounced in favor of adequate monopoly of service, with proper regulation of rates, that the fear of unreasonable competition is largely removed.

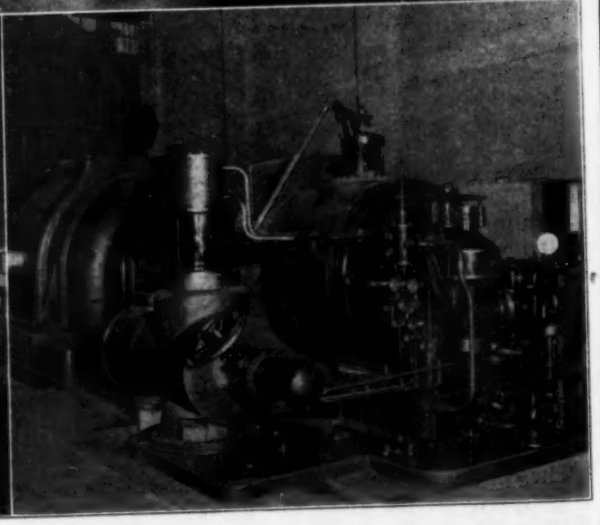
With this increased assurance of continued business there comes the restriction of limited profits, so that the speculative value of common stocks of utility companies is considerably limited, due to the fact that high rates are not likely to be in any case approved by the commissions. On the other hand, the safety of preferred stocks and bonds is considerably increased. In many cases, any considerable extension of the present period of high prices will necessarily result in increased rates being needed by the public service companies in order to adequately provide for maintenance, depreciation and obsolescence, and continue reasonable returns on the capital invested.

Some commissions have already shown a disposition to recognize high operating costs by permitting reasonable increases in rates.

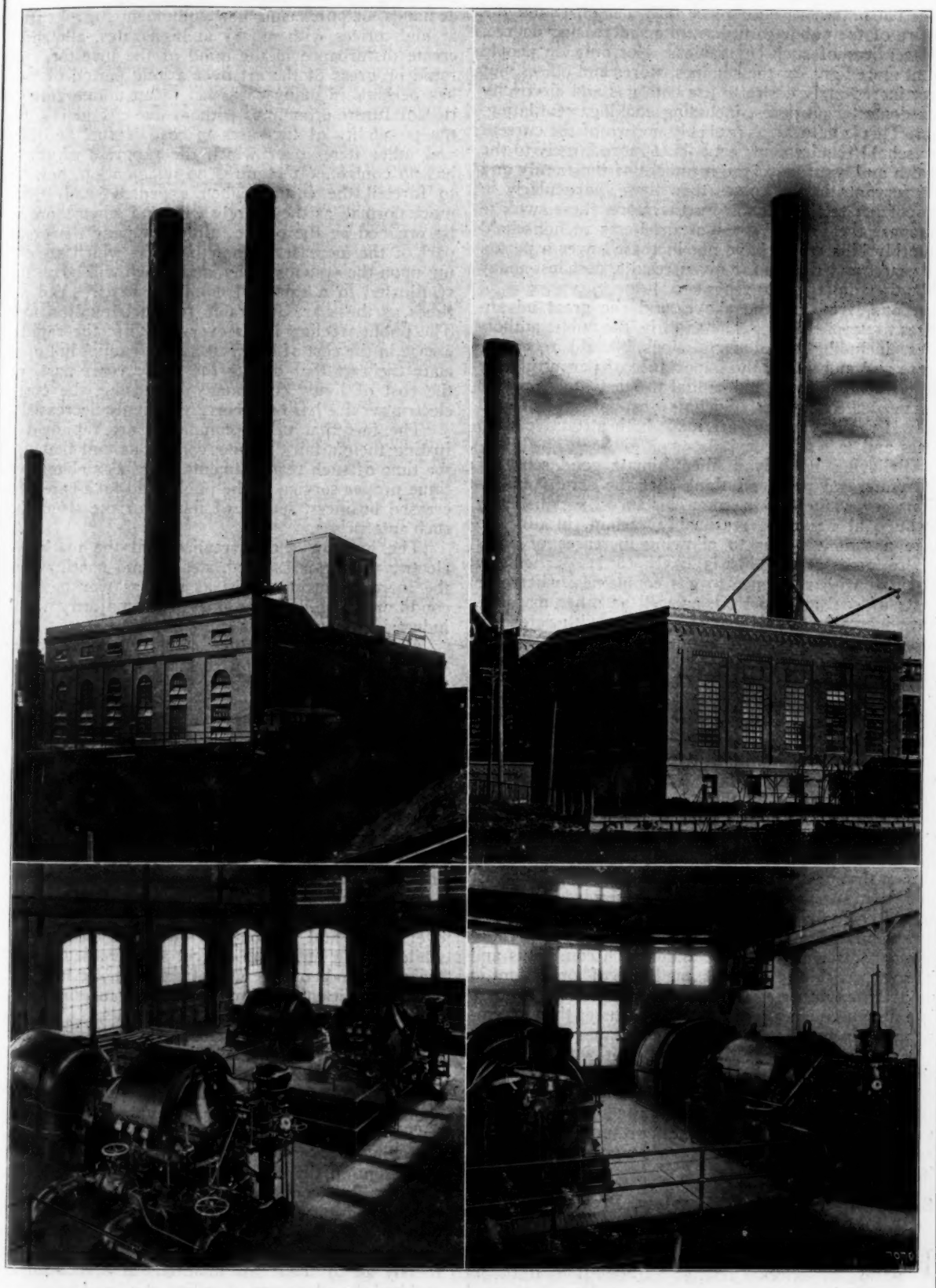
If it could be definitely known that commissions generally would take a similar attitude, it would seem that the securities of public service corporations should continue to be even greater favorites with investors than has been the case in the past. Naturally, this should be the result with increased assurance from

TYPICAL PLANTS SHOWING CHARACTER OF ESTABLISHMENTS





WHICH INSURE INVESTMENTS IN ELECTRICAL SECURITIES



unwise competition, coupled with the maintenance of the same return on capital.

The experience of utility companies, particularly electric light and power and gas companies, during the past ten or twenty years has fully demonstrated the desire of the public to utilize, to an increasing degree, the services of such companies. Not only do people want more light for their homes, stores and offices, but they increasingly desire to use both gas and electricity for domestic purposes, including cooking, ventilating, etc. This is natural, as probably no two of the current household requirements contribute more largely to the health and comfort of the members of the family and the servants in the homes than these, particularly in proportion to their cost. Furthermore, these two are amongst the very few important items in household monthly bills which have not increased over a period of years, and which, for given results, cost less today than they did 15 or 20 years ago.

Considering all the above, and the great advantages to people of all stations in life, the public authorities, including state commissions, should recognize more and more fully the importance of permitting the utility companies to find capital to adequately provide for needed extensions. Such new capital can be found only if the investments are made both attractive as to rates and safe as to capital.

Believing strongly in the ultimate good sense of the American people, I think that the state commissions, even though in some instances socialistically inclined at first, are reasonably certain, in time, to take a sane view as to allowing increases of rates where necessary. This is likely to be particularly essential with reference to gas companies, where the costs of coal and fuel oil, as well as other material, have increased very largely; and also with reference to street railways, where all operating costs, including wages, have increased very greatly, and where, even at old established rates for these operating supplies, the service was inadequately paid for, especially if proper allowance is made for depreciation and obsolescence.

While it may be difficult to get these increases in rates, yet it seems probable that with patience and a fuller appreciation on the part of the public authorities, and of the public also, of the excellent values they are getting in proportion to what they are paying, increases will be acceded to where it can be clearly shown that they are necessary. In that event, the past popularity of investments in public service companies would not only prove to have been justified more and more, but people should be interested both because investments would be safe under such conditions and because, with the present methods of operation in many cases under state commission supervision, there is a minimum chance of any serious losses through unscrupulous handling or incompetent management.

Your periodical is doing excellent work both for the public and for the utility companies in helping to educate the public, and this usefulness can be increased if it covers not only the desirability of the securities as investments, but also the importance of increased rates in many cases, in order that good service may be maintained.

Statement from W. S. Barstow, President, W. S. Barstow & Company, New York.

PUBLIC utility securities are passing through a period of extreme test, as all conditions unfavorable to such enterprises are present today. Increased expenses due to abnormally high cost of coal and labor with no corresponding offset of increase in rates (although such offsets are just now going into effect), the necessity, in order to preserve public good will by providing for the unusual increases in new-business demands, of purchasing new equipment for extensions at high prices with money at high rates, all tend to create disturbance in the mind of the investor. The rapid progress of the art over a long period of years has perhaps in many cases led to an undue anticipation of future economies without due consideration of the possibility of increases in cost of fuel and labor and other items over which the progress of the art has no control. It requires no imagination, however, to foretell the future, when expenses shall become more normal, as they surely will, and when there will be retained by the public utility company the greater part of the increases in new business which are coming upon the systems today, and which will be on rates readjusted to a fair and equitable basis. And such times as these are favorable for such readjustments. The public, feeling in its every-day life the rapid increase in the cost of every necessity, cannot but appreciate the fact that during the many years past, with the cost of living continually increasing, the cost of electric service has been correspondingly decreased.

The fact that utility companies are rapidly readjusting their affairs to new conditions and that up to the time of such readjustments have been able to continue proper service to the public and take care of increased business, speaks of itself for the strength of such enterprises.

The investor should realize that the market for electric service is assured, steady, and continually on the increase during peace as well as war periods, a condition which does not exist in the majority of other industries calling for his capital.

Public utility securities cannot help but emerge from this war period in a very much stronger position than heretofore.

Statement from Henry L. Doherty, President, Henry L. Doherty & Company, New York.

WHILE the present situation in regard to public utilities, or any other branch of business where the selling price is more or less fixed, is annoying, yet I feel that the period through which we are now passing will prove to be a healthy one for public utility enterprises and public utility securities.

It is somewhat disturbing to the public utility company to see everything that they buy advanced at will over night, and without review of any public body, while they in turn can only get an increased price for their commodity after a protracted public hearing by a state public utility commission or some similar governmental agency.

Under the usual limits of variation which occur in the business world, the public utility demonstrated a degree of stability which was inherent to no other business. When times of great business activity came about the public utility company was compelled to pay an increased price for all of its raw materials while its selling price remained fixed. This led to the peculiar situation that in some cases the earnings of the public utility companies were less in times of great business activity than in times of business depression. On the other hand, when periods of business depression came about, the public utility companies were able to buy all of their raw materials at a reduced price and had the advantage of selling at a fixed price. This led to the condition in many cases where the public

utility company earned more in times of business depression than in times of business activity.

The situation was one that produced a highly stabilized earning power, which has only been recognized in the past few years and not yet fullly appreciated.

It is only in times like the present—that do not occur once in a generation—when the usual variations between subnormal and abnormal market conditions are so far exceeded as to seriously affect the earnings of public utility companies.

Constant improvement in the public utility field of operation, and especially the ability to generate power at a lower and lower cost, have brought about constant reductions in price, until the public had begun to look for changes in price only in a downward direction.

The present situation will require a re-survey of the public utility company from a new angle.

Relief from the present situation is purely a matter of time. The public utility companies have been performing a service at a price far below the value of this service to the customer; therefore there is no danger of loss of trade by higher prices. The public utilities commissions realize the situation. Their attitude is constructive. Delay is our only complaint.

The present situation will curb public opinion in the belief that it is entitled to a constant lowering of prices, and will also make possible reforms in the methods of charging.

The high price of coal, and the difficulty of getting coal by operators of isolated plants, have made it possible for the central-station companies to take on business at this time which has heretofore been difficult to secure, and this business will remain with the central-station companies and prove highly profitable when normal conditions are re-established.

We look on the whole situation as one which is momentarily inconvenient and unpleasant, but one which will prove highly beneficial in the long run and one which will make public utility properties the most desirable to the investor in the period of reconstruction which must inevitably follow, and while other lines of business will be seriously handicapped by a change to normal conditions, whether the process is one of evolution or revolution, the public utility company will reap its benefits during this period and thereafter.

DETAILS OF DOHERTY PROFIT-SHARING PLAN.

Employees Allotted $3,000,000 in Cities Service Stocks to Be Apportioned in a Unique Manner.

Profit-sharing is nothing new to the large American corporation. For the past ten or fifteen years numerous plans have been put in operation designed to give the employee a share in the organization of which he is an individual. The profit-sharing schemes in operation vary from distributing bonuses at the end of the year to giving stock to employees and adding to their salaries by dividends.

That profit-sharing is here to stay, and that each year it will be more firmly entrenched as an institution in American business, is attested to by its adoption by a great many different kinds of industries. Manufacturing industries are the logical sources of profit-sharing schemes, as the idea works for the benefit of the employer as evidently as for the employee. One of its newest applications is to the public utilities business.

The plan recently perfected by Henry L. Doherty & Company, operators of Cities Service Company, is perhaps further advanced than any profit-sharing scheme which has yet been put into operation. It makes possible the ownership of stock by the smallest salaried employee in the entire organization, and, because of that, its basic ideas will probably be adopted by other corporations desirous of instituting a profit-sharing plan.

As formulated, the profit-sharing system that will be in operation in the Cities Service Company after August 1, has for its cornerstone the installment payment plan. Any member of the Doherty organization may subscribe for stock, and the amount of his subscription depends upon the length of his employment and the amount of his yearly salary. Those who have been employed less than five years are permitted to invest only an amount representing a certain proportion of their salary. For example, a man employed less than a year may subscribe for stock equal in amount to 50 per cent of his yearly income. A person employed 3 years and less than 4 may invest 80 per cent, and so on. Furthermore, certain limitations are placed upon the amount, so that those with the biggest salaries may not buy too much of it.

The reason a limit had to be placed upon the amount of each emloyee's subscription, is that the terms of subscription are so attractive that every employee is tempted to buy as much stock as possible, and there is only $2,000,000 in par value of the preferred stock, and $1,000,000 in par value of the common, available for distribution to the employees.

A further restriction upon the investor is that whatever money he invests in Cities Service stock will be used to purchase twice as much preferred stock as common. Thus if a person invests $300, two-thirds of it, or $200, goes toward the purchase of preferred stock, the remaining $100 for the common.

(1.) Interest at 6 per cent will be charged on deferred payments applying to the purchase of common stock. All interest charges will be adjusted at the time of the final payment.

(2.) The subscriber will receive preferred stock each month according to the amount of the installment paid, but no common stock will be delivered until two-thirds of the total subscription has been paid.

(3.) Dividends on the common stock will be credited to the account of the subscriber. On stock delivered to subscribers all dividends will be paid directly.

(4.) Subscribers desiring to pay installments in advance may do so, and they will be allowed 6 per cent interest on such payments, but stock will be delivered only from month to month in proportion to regular monthly payments.

(5.) In cases of emergency an effort will be made to make loans to employees with the stock as security.

(6.) In the event of termination of employment the purchaser will be permitted to exchange an amount of preferred stock already delivered for an equal amount in par value of common stock, so that the purchaser may have an amount of both common and preferred stock equal in par value to the aggregate subscription payments made up to that time, and in the proportion of two-thirds of preferred to one-third of common.

(7.) Upon special arrangement with Henry L. Doherty & Company a person leaving the employ of the Cities Service Company may continue to pay installments; otherwise the company will buy back the delivered stock at the purchase price. A readjustment similar to the scheme outlined in this and the preceding paragraph applies in event of a subscriber's death.

Static Transformers Used as Boosters

Standard Distributing Transformer May Be Used as a Constant Booster—Voltage Relations—Precautions to be Observed

By F. S. FLETCHER

THE static transformer used as a booster often offers a very convenient and ready means of increasing the voltage a definite and constant amount. In these times when copper is extremely high in price, the booster may be economically employed to increase the voltage of a circuit to compensate for line drop where ordinarily increased cross section of copper would be employed. The chief disadvantage of the static transformer used as such for raising or lowering voltage is that the increase or decrease remains constant, whereas this is not always what is desired. In such cases the induction regulator is indicated.

Where there is insufficient copper and excessive line drop, therefore, the booster transformer is useful, hence it may serve some useful purpose to point out how several combinations may be easily obtained from the standard distributing transformer by simply changing the external connections.

The booster transformer, which by the way may be used to buck instead of boost by simply reversing one winding, consists of one winding connected in shunt across the line while the other winding is connected in series with one side of the line. Different results will be obtained whether the primary or shunt winding is connected between the source of supply and the series or secondary coil or whether it is connected between the secondary coil and the load, a fact that may be utilized to good advantage sometimes. To make the matter clearer, suppose a standard 10:1 2,000-volt distributing transformer is used. With the primary connected as shown in Fig. 1-A, namely between the source of supply and the booster secondary, the boost is 200 volts and the total voltage is increased from 2,000 to 2,200. If instead the primary is connected "ahead" of the secondary as shown in Fig. 1-B, which is between secondary and the load, a higher boost is effected by an amount equivalent to the voltage of the secondary expressed as primary voltage. The voltage on the boosted side would then be 2,222 volts instead of 2,200; the extra 22 volts may often be very serviceable, especially since it is so easily obtained.

It is quite a simple matter to calculate the effect of connecting the primary of the booster between the secondary winding and load instead of between source of supply and secondary winding, and thus determine beforehand the effect of the change. For example, suppose the transformer is a standard 2,000-volt unit, with a ratio of 10 to 1, that is with a secondary of 200 volts. If X represents the resultant voltage on the load side of the booster, when connected between booster and load, then the increase of voltage due to the secondary winding is given by $X/10$. The total boost is then expressed by $X = 2{,}000 + X/10$ whence $10X - X = 9X = 20{,}000$ and therefore $X = 2{,}222$.

The boost is thus seen to be from 2,000 to 2,200 or 2,222 volts, according to which connection is used.

So far a single transformer in a single-phase circuit only has been understood. The use of three transformers in the three-phase circuit is interesting in more ways than one.

Booster Transformers on Three-Phase Circuits.

It is generally understood that by connecting three single-phase transformers in star instead of delta in a three-phase circuit that for a constant supplied voltage the transformed voltage will be increased over that corresponding to the transformer ratio by $\sqrt{3}$ or 1.732, with the same stress between turns. In view of this fact it might be taken for granted that in arranging three transformers to act as boosters in a three-phase circuit a higher boost would be obtained by connecting the shunt windings in star instead of in delta. In actual fact the reverse is the case, that is, by using a delta connection, a higher boost is made possible. The method of connecting three transformers in star and delta is shown in Fig. 2, and the corresponding voltage diagrams in Fig. 3. It is seen that if the transformers have the standard ratio of 10 to 1 then by connecting the booster transformers in star the percentage boost is 10 per cent, whereas by connecting them in delta gives 15 per cent. By connecting the primaries between load and booster, as already pointed out, an intermediate voltage can be obtained with the star connection and a voltage in excess of 15 per cent with the delta.

Capacity of Booster Transformers.

The capacity of the booster in all cases is governed by the capacity of its secondary winding, that is the winding in series with the circuit, which is the low-voltage winding. For example, if the circuit carries 50 amperes, then the booster must be a transformer whose low-voltage coil is capable of carrying not less than 50 amperes. In the above instance the

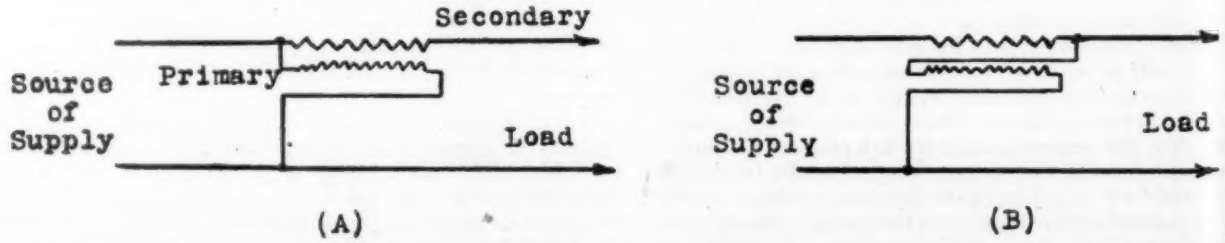


Fig. 1.—Installation of Primary "Behind" Booster in (A). In (B) Primary is Connected "Ahead" of Booster, for Additional Voltage Increase.

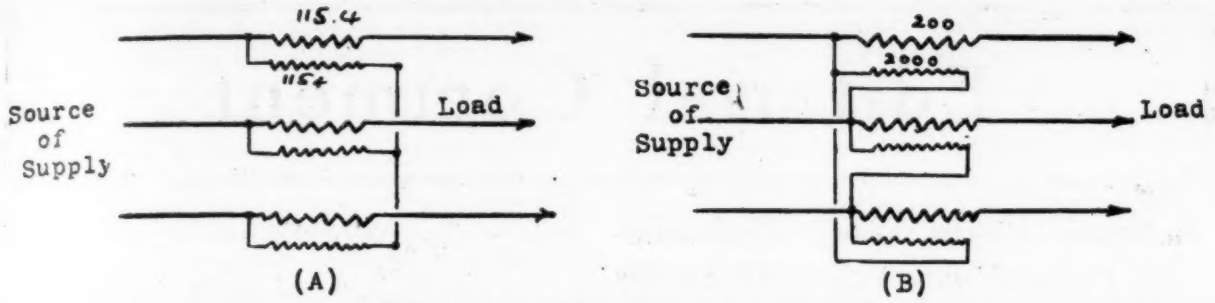


Fig. 2.—Three Single-Phase Transformers Connected in Star in (A) and in Delta in (B) as Boosters in Three-Phase Circuit.

booster would require a capacity of 10 kilovolt-amperes while the actual load was 100 kilovolt-amperes.

If burnouts are not to occur it is important not to forget to keep the capacity of the booster transformer on the safe side. This is even more important where the primary is connected on the "boost" side since the impressed voltage on the transformer primary is then higher than it is when connected on the other side; moreover, it is also higher than the voltage for which the transformer was designed. This means that the core or iron losses will be higher, hence also the overall heating. Still further increasing the heating, and thereby tending to lower the capacity of the booster, is the fact that with the ordinary transformer the load does not persist continually, that is the load-factor is not commonly 100 per cent, while with the booster the high voltage exists so long as the line is alive, although of course the load may vary.

Need for Proper Insulation.

In using ordinary static transformers as boosters there is one other thing that is very important to remember. That is that the service is other than that for which the apparatus was primarily designed, and if neglected the insulation may be subjected to excessive voltage or dielectric stresses. The standard distributing transformer is designed for about 10,000 volts between high-voltage coils and case, while the 220 volt or low-voltage coils are designed to withstand a test pressure of 4,000 volts for one minute between coils and core and case. When used as a booster the secondary coils are raised about 2,000 volts continuously above ground instead of only during the application of a test voltage. Such sustained voltage may cause breakdown of the secondary. The remedy is to insulate the transformer case from earth. When used upon a pole the insulation occurs automatically, since the pole acts as the insulating medium.

Transformer vaults and houses are coming into increasing use now, however, and in such cases the transformers are usually placed upon the floor. Where transformers are used as boosters it is safer, as regards the apparatus and workmen, to place them upon a slightly raised platform of dry wood. In any case where stationary apparatus, such as the oil-cooled transformer, is operating at full load it increases its current-carrying capacity to raise them above the floor level so that air is able to circulate underneath them, thus further assisting the circulation of air and the dissipation of heat.

Illinois Commission Vetoes Rate Increase.—The Public Utilities Commission of Illinois has annulled the schedules for increased power rates proposed by the Rockford Electric Company, a subsidiary of American Gas & Electric Company.

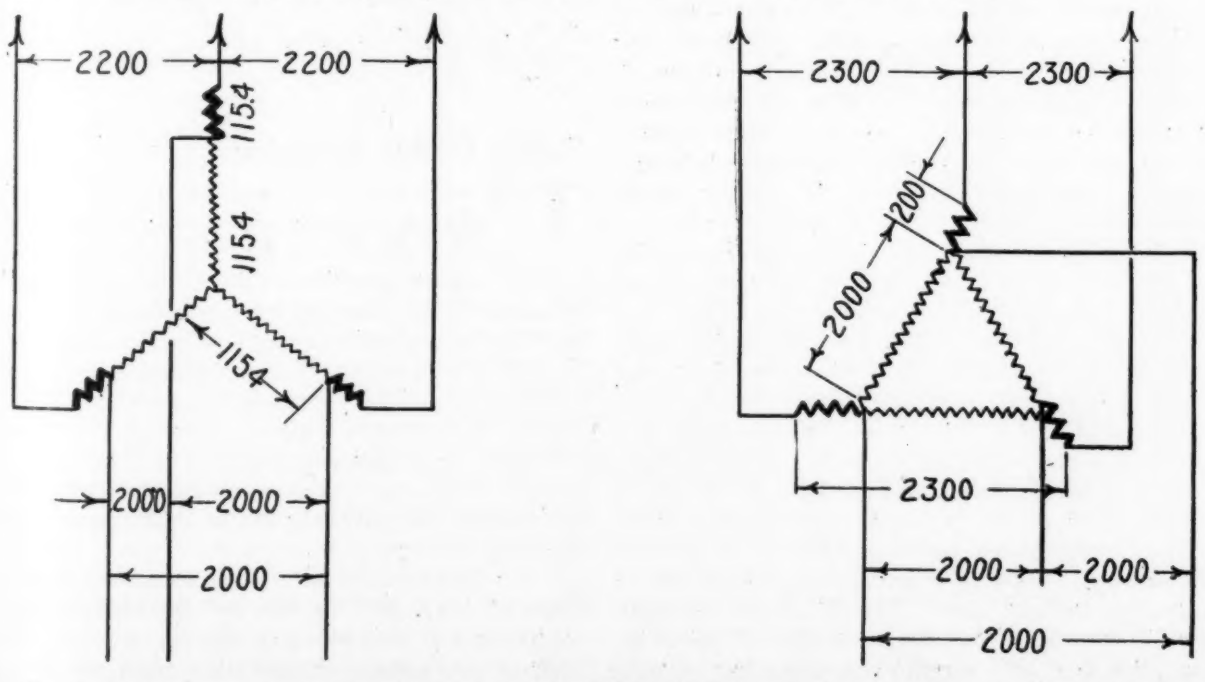


Fig. 3.—By Connecting Booster Transformers in a Three-Phase Circuit in Delta Instead of Star a Further Gain in Boost of 5 Per Cent is Obtainable.

Editorial Comment

To Supply Vitally Needed Hydroelectric Power, Massachusetts Authorizes Securities in Advance of Construction

THE Gas and Electric Light Commission of Massachusetts recently authorized the issue by the New England Power Company of a stock and bond issue amounting to $7,000,000 par value to provide funds for important extensions, improvements and development work, including the building of a new hydroelectric power plant on the upper Deerfield River, the construction of a large reservoir and the raising of the transmission pressure on parts of the system to 110,000 volts. A proposed outlay of this size under present conditions of labor and material cost is noteworthy in itself, but in this decision of the Massachusetts board a point of special consideration is the willingness of a majority of the Commission to authorize the security issue in advance of any comprehensive construction accomplishment.

The company maintained at the hearing that, on account of present financial conditions growing out of the war, it would unquestionably be much more difficult to raise the funds required for these improvements without the advance permission of the board, and so the Commission granted the issue, although a minority member in the person of Commissioner Lewenberg voted against it. The minority opinion held that the company's credit should be adequate to enable it to finance the development without seeking the approval of the board for security issues until a substantial outlay had been made. The point was also brought out that the probability of the work's being handled in the field by a construction organization affiliated with the company tends to raise the bids of outside contractors and lead to excessive costs on the job.

It is hard to escape the conclusion that the majority of the board in granting the issue performed a real service to the industry and to the country in this case. *There never has been a time when hydroelectric power was in such demand in the seaboard manufacturing states served by this particular company as at present. The cost of coal is so high as to literally put a premium on water power, and, regardless of present labor and material prices, power must be had.* With the country getting deeper each day into the most terrible war of history, every possible resource must be turned to account in order to defeat the common enemy of ourselves and our allies. This is no time for technical obstruction, however well intended, of actual accomplishments of a constructive character. Cost is really a secondary consideration; results are what we must have, and, so far as possible, those results should be obtained in the easiest way.

It is true that in its usual practice the Commission has based its approvals of security issues upon analyses of actual expenditures, supplemented when necessary by estimates as to the cost of completing the work in hand. In the present case it had to depend upon estimates alone, but those were in sufficient detail to permit the exercise of no little engineering judgment upon their general standard of reasonableness. The data submitted to the board were prepared by the most experienced hydroelectric organization in New England, all things considered, and by the engineers who have designed, built and operated the largest system in that section. It is well known to outside contractors that they must put their bids below those of the company's own organization if they are to obtain this work, and there is little or no evidence in the existing system of plants and transmission lines that money has ever intentionally been wasted in their construction. After all, the economic demand for power is so great that under present conditions it would be worth a good deal to the public and indirectly to the government if the proposed power developments could be carried through at abnormal speed, even at the expense of a higher subsequent fixed charge than would obtain in ordinary times. The additional facilities are imperatively needed, and if these can be obtained more readily by the advance approval of the Commission it is safe to say that the giving of that approval by no means implies the abdication of regulatory jurisdiction by the board.

Public Utility Securities

THE conditions affecting the securities of public utility companies present an unusual combination of factors. In the first place, the unprecedented industrial activity in this country has created an extraordinary demand for central-station service, resulting in increased earnings for many companies. On the other hand, the cost of fuel, labor and material has made tremendous advances, while rates for electric service have remained constant. However, Public Service Commissions are reasonably certain, in time, to take a sane view of the situation and allow increases in rates where it can be clearly shown that they are necessary.

As pointed out by Mr. W. S. Barstow, on other pages of this issue, it requires no imagination to foretell the future when expenses shall become more normal, as they surely will, and when there will be retained by the public utility companies the greater part

of the increases in new business which are coming upon the systems today, and which will be on rates upon the systems today. Rates for such service must and will be readjusted on a fair and equitable basis.

The conditions which are responsible for the increased business of the utility companies have a further influence on their securities. The great volume of business offered the industries of the country necessitating large plant extensions results in an increased demand for capital with which to make the required additions. This has a direct bearing on the security market in that, as the demand for capital for many and varied industries is increasing at a rate greater than its supply, a decreased demand for securities results, and as the market price of securities is determined in the first instance by the relation between the supply of funds and the amount of securities offered for sale, a depreciation in the market prices for public securities naturally results. Furthermore, since the declaration of war by the United States, the normal investment market has been stagnant, due to the natural hesitancy arising from the new and unfamiliar status of all public and private affairs. As pointed out by Mr. F. K. Shrader in a paper before a recent meeting of public utility operators, which is abstracted in this issue, the public utility service in this country comprises a business of substantially one-half the proportions of the steam railroad business measured by the invested capital and gross earnings. The investor should realize that the market for electric service is surely, steadily and continually on the increase during peace as well as war periods—a condition which does not exist in the majority of other industries calling for its capital.

Much new capital is needed and the investor in public utility securities clearly performs a patriotic service as well as one to his own financial welfare. This is clearly the time to take advantage of conditions which, while temporarily depressing the market price of securities, are certain in the long run to materially increase their intrinsic value.

Radio Stations in Time of War

SINCE the United States entered the world war the public has been strictly excluded from radio stations under government control and operation, and very properly so. The restrictions imposed are for the good of the service, which has never been so important as today. Private citizens with electrical affiliations may regret the withdrawal of the hospitalities extended them in previous years, especially where the command of an installation remains unchanged; but the policy of exclusion is safest. We commend to every electrical man who comes in contact, on vacation or otherwise, with the staff and guards of a radio station under present conditions cheerful acceptance of all regulations and restrictions in effect, no matter how much of a privileged character he may have been a year ago.

It is true that electrical affiliations before the war often proved an open sesame to governmental establishments, and many profitable hours have been spent by representatives of our great industry in making friends with the men and the equipment of the naval radio stations scattered along the coast. Now that we are at war interest in the work of such stations is naturally greater than ever. No civilian should expect, however, to be given any "inside" information about the plants. As a matter of fact, the operators themselves handle a large amount of traffic which is coded in such a manner that it is meaningless even to them. Accuracy of transmission and careful checking are most important under such conditions.

The movements of our naval vessels are no longer heralded by radio messages sent broadcast through the ether phrased in plain English and read as easily by the enemy as by friends. The goings and comings of our fighting ships are not reported by marine observers and it would be a gross violation of orders to disclose such information. It is natural for an electrical visitor to a shore resort near which is a radio plant manned by former friends to desire to learn something about the movements of patrol craft, but it often happens that most of the shore stations know very little about these matters. Centralization of control has been effectively applied to the movements of coast-defense vessels as well as to ships engaged in overseas service, and this means that while the naval operators know more than the general public about events on the sea, they are after all only parts of the great war machine and with rather limited functions This is not the case with headquarters stations, but it is representative of local or district plants.

Coastal radio stations are very carefully guarded at present by detachments of marines, naval reserves, or both. Flood lighting is being used to some extent in radio-aerial and yard protection and the barbed-wire inclosures are unhealthy places to approach at night in a careless way. High voltages are available at some plants to discourage familiarity with the fencing. The latch string has been pulled inside, and electrical men not in the service must content themselves with implicit obedience to the regulations and to the orders of those on duty, no matter how trivial these may seem.

Only a few weeks ago one of the most powerful financiers in the country was ordered off the premises of a naval radio station on the Atlantic coast and the United States Supreme Court has since sustained the marine on duty for obeying orders despite a technical charge of assault laid against him by the magnate of Wall Street. It is well for traveling electrical men to realize that, although the Government means business in barring all outsiders from these centers of electrical communication, it is still possible to maintain the most friendly relations with the boys in the service, provided one appreciates the situation in which we are all placed by the common need for co-operative defensive and offensive measures against our powerful enemy and his wily agents.

HAPPENINGS IN THE INDUSTRY

An Account of England's Fuel Policy—Water Powers in the Northwest—Electric Cooking Meeting at Richmond —Technical Men Are Needed—Miscellaneous News

HOW ENGLAND IS MEETING ITS PROBLEMS OF FUEL SUPPLY.

Precautionary Measures Include Recommendations That Factories Buy Power and Central-Station Service for Cooking and Heating Also Urged.

Very thorough measures have been organized by the British Government Department which has been established to secure provision and proper distribution of coal for all essential purposes during next winter. The Controller of Mines aims, with the co-operation of an expert staff of advisers, including several managers and engineers of electric supply undertakings whose services have been lent for the purpose, at securing adequate supplies of fuel for industrial, public, and domestic requirements. The organization has elaborated schemes which shall prevent needless use of the railways by giving the user his supply from the nearest collieries, and which will also secure greater economy in consumption. The first part of the scheme which has now been put into force is estimated to effect a saving in railway transport of not less than seven hundred million ton-miles annually. It is based upon four main issues:

(1.) That consumption of coal should take place as near the producing point as possible.

(2.) That in view of the superior facilities afforded by the main trunk lines, the movement of traffic should follow these routes wherever possible.

(3.) That the movement of coal should, as far as possible, be in well-defined directions, viz.: North to south, north to southeast, north to southwest, and east to west.

(4.) That an area producing less coal than suffices for its own needs should not send any portion of its output to other areas. That an area producing more coal than it requires for consumption within the area itself, should only distribute the balance to adjacent or convenient areas.

In the case of users needing fuel of a special type for special purposes, certificates are issued under arrangement by the Controller's Department.

In regard to the economies which can be effected in the use of coal, the Controller has issued a number of suggestions. One of these is that factory owners throughout the United Kingdom who are at present generating their own power by means of coal, should make arrangements for taking their power requirements from an outside source, in districts where the existing power supplies have a margin available. The Controller undertakes to assist as far as possible in obtaining priority for plant, machinery and motors required, provided a substantial coal-saving can be demonstrated. He suggests, among other things, the curtailment of early and late tramway running, and the prevention of unnecessary use of water. He further advises the accumulation of stocks in the summer months of the coal required during the winter, the cost of storage being considered as a form of insurance against the probable coal shortage.

Electric cooking and heating in public and private buildings are urged both as a means of coal-saving, and in order to lessen serious inconvenience which irregular or insufficient local distribution might cause in the winter. Electric supply authorities should obtain Board of Trade powers to disconnect classes of non-essential consumers in cases of urgent necessity so that they may be able to continue the supply to munition works and other essential users.

Interconnection arrangements, to which reference has already been made in these pages, are advocated, with a view to enabling neighboring towns to interconnect electric distribution systems or generating plants by means of underground cables, or, in suitable cases, of temporary overhead wires over the intervening country. One or two of the most economical power stations in each district will thus be able to supply several towns at light load, instead of each town having to run its own power station uneconomically at such times. This would also enable the various power plants to shut down in turn during week ends and holidays to effect plant repairs, and would provide some amount of power at call as a standby in case of coal supplies giving out locally.

It will be obvious that in the above ways the national economy and efficiency which are so necessary under the strain of war-time conditions can be secured and electric supply authorities may obtain freedom from some of the serious difficulties that have confronted them during the last two winters.

DEVELOPED AND UNDEVELOPED WATER POWER IN THE NORTHWEST.

Interesting Estimates of Hydroelectric Possibilities on Numerous Streams.

Eastern Washington and Northern Idaho constitute a section of country often referred to as the Inland Empire. This name is commercial and industrial in its significance, rather than geographical. It applies to a vast region lying east of the Cascade range, which is drained by the upper Columbia, its many tributaries, and the lower course of the Snake River and its branches. The entire region is well-watered by streams and lakes, but semi-arid, so far as rainfall for vegetation is concerned. The valleys are irrigated, and the undulating sections and plains are devoted to cereal raising without irrigation.

The conspicuous feature of interest to ELECTRICAL REVIEW readers is the vast water-power resources encompassed in that part of the country. Hydroelectric power already developed and in use amounts to 200,000 horsepower; and undeveloped water-power sites, according to estimates made under authority of the Spokane Chamber of Commerce, represent over 1,800,000-horsepower possibilities.

The principal development, thus far, is on Spokane River, where 172,000 horsepower is utilized; other power developed and in use is on the Okanogan, Yakima, Similkameen and Clark's Fork. It is estimated that unoccupied sites elsewhere on Spokane River represent about 100,000 horsepower in possibilities. The other streams having vast undeveloped power resources are the Priest and Pend O'Reille Rivers, tributaries of the Columbia, and the Salmon which is the largest tributary of the Snake River. Great power possibilities on the Columbia are recognized as existing at Priest Rapids, Kettle Falls, Umatilla Rapids, and at the mouth of the Chelan. Recognized power sites on the Snake are at Asotin, near Lewiston, Idaho, at Palouse Rapids, Coon Hollow, Cherry Creek, Mountain Sheep and Salmon Tunnel. The upper reaches of Yakima River have considerable power development, one of which is at Ellensburg.

UNDEVELOPED WATER-POWER SITES.

The power possibilities of the numerous streams referred to are shown in more detail in the following estimates:

Spokane River—	
Week's site, near Trent bridge	8,000
The Narrows, 1½ miles above mouth	13,000
Smelter site, 2 miles northwest of Spokane	5,500
Estimated possible addition	75,000
Priest River—	
Near mouth (Panhandle Electric)	13,000
Seven miles above mouth (Panhandle Electric)	7,000
Pend Oreille River—	
Metaline Falls, two miles below falls	10,000
"Z" canyon	80,000
International Electric Co. sites, across B. C. line	80,000
Salmon River—	
Whitebird, Wolbert and Oxbow sites	100,000
Columbia River—	
Priest Rapids	250,000
Kettle Falls	80,000
Chelan River mouth	75,000
Umatilla Rapids	120,000
Snake River—	
Palouse Rapids	50,000
Asotin site	55,000
Coon Hollow	200,000
Cherry Creek	200,000
Mountain Sheep	120,000
Salmon River tunnel	200,000
Additional to Mountain Sheep	80,000
Total	1,821,500

The Washington Water Power Company's modern equipment and large production of electric power on Spokane River have kept pace with a rapidly increasing demand for light and power service within a 200-mile radius. The cement plants, mines, concentrating mills, paper mill, shops, factories, saw-mills and interurban railroads are all served with electric current from central-station plants. As industries expand the use of this power will increase; and the demonstrated adaptability of electric power, the practicability of long-distance transmission, and the assurance of an ever-increasing supply, constitute factors which create demands.

These facts may serve to emphasize the importance of water-power legislation that will make available such matchless resources as rapidly as industrial demands require them.

ELECTRIC COOKING TO BE DISCUSSED AT RICHMOND.

Central-Station Representatives from Virginia and Carolinas to Hold Conference.

An electric cooking conference to be participated in by representatives of central-station companies from Virginia, North Carolina and South Carolina will be held at the Jefferson Hotel, Richmond, Va., August 17. The meeting is to be an open one and all interested in the subject are invited to attend.

A number of questions pertinent to the subject have been prepared upon which there will be a round-table discussion. Among the more important ones are the following:

(1) Is a 3.5-cent rate low enough to obtain the electric cooking business?

(2) What class of people are the best prospects for electric cooking?

(3) How can we solve the "heating of water" problem?

(4) Do you find it practical to put ranges in homes where colored servants are employed?

(5) How do you evade a request to place an electric range on trial?

(6) Should the lighting company or the customer pay for the cost of the inside wiring?

(7) Which is the better, six monthly or twelve monthly payments?

(8) Do you recommend the selling of ranges at a cut price?

(9) What advertising do you recommend in connection with a range campaign?

(10) How do you overcome the objection that the electric range will not heat the kitchen in the winter?

(11) Is it necessary to teach the housewives how to cook with the electric range? How do you accomplish this?

(12) Do you recommend public demonstrations on the electric range? If so, how should they be conducted?

(13) How do you train your salesmen to do their work effectively? Do you furnish an instructor to train your customers?

(14) How do you recommend that salesmen be paid—on a salary or a commission basis?

(15) Do you advise the use of a saleslady in preference to a salesman?

THE ECONOMY AND CONSERVATION OF FREIGHT CARS.

Traffic Director of Chicago Association of Commerce Urges Loading to Capacity.

As a matter of economy in the use of cars, shippers are being urged to buy and load heavier. The necessity and practicability of doing this is set forth in an address by Henry C. Barlow, traffic director of Chicago Association of Commerce, at a car conservation meeting, at Hotel La Salle, Chicago, July 17. He called attention to the fact that this country has today 40,000 fewer cars than in 1914, but said the carrying capacity of what we have is greater than that of the larger number in 1914. The shipper, in standing on his rights to load the minimum, often deprives others of their right to have cars. The speaker said a successful effort is being made to induce shippers to load heavier, and asked that purchasing agents and material departments be so instructed. Dealers and commercial concerns were urged that promptness in loading and unloading cars was essential. In this connection Mr. Barlow said: "Once more, please; are you loading and unloading your companies' coal, material and supplies with the same promptness and despatch you properly require at the hands of the shippers? If not, why not? Have you any right to delay a car which right the shippers should not enjoy? Won't you please look to this because you can help as well as the shippers? You may be surprised at what your investigation discloses. Under M. C. B. Rules, a surprisingly large number of cars are put out of service seemingly an unusual length of time, awaiting proper parts with

which to make repairs; that is, for just the right brake beam, etc. In the present emergency, cannot this be avoided by putting on a safe brake beam, thereby getting the car back into service at once. Please look into this."

CONVENTION OF MUNICIPAL ELECTRICIANS AT NIAGARA FALLS, SEPT. 11 TO 14.

Secretary Issues Call for Large Attendance—War Problems to Be Discussed by Able Men.

Clarence R. George, secretary of the International Association of Municipal Electricians, sends out an appeal to all members to attend the annual convention at Niagara Falls, N. Y., September 11 to 14, inclusive. Arrangements for the convention and the reception of delegates are in the hands of M. J. Donohue,, city electrician of Niagara Falls. The secretary urges, as a patriotic duty, that the electrical branch of municipal governments be put in complete state of preparedness, and states that able papers by eminent men will be presented and these should be heard by all members.

Exhibits are desired, for which free space will be furnished. Headquarters are to be at the International Hotel, Niagara Falls.

The officers of the association are as follows: Robert J. Gaskill, president, Ft. Wayne, Ind.; Chas. P. Steinmetz, first vice-president, Schenectady, N. Y.; Claud E. Convers, second vice-president, San Antonio, Texas; John Thomas, third vice-president, Scranton, Pa.; John W. Bleidt, fourth vice-president, Little Rock, Ark.; Clarence R. George, secretary, Houston, Texas; C. E. Diehl, treasurer, Harrisburg, Pa.

MEN OF TECHNICAL TRAINING ARE IN GREAT DEMAND.

Services of Engineers in All Branches Deemed Essential to Successful Prosecution of the War—An Appeal to Technical Schools.

The University of Illinois, Urbana, under date of July 26, has issued the following circular letter concerning existing demands for men of engineering skill and training, with accompanying facts by P. P. Claxton, United States Commissioner of Education, which speak for themselves in a strong appeal to technical men and technical students:

Never in the history of this country has there been so great a demand for men having technical training in engineering as at present. The war in Europe has been a war of engineers and of the product of engineers, and every effort has been made by the European powers to conserve and increase the supply of men who are competent to carry on the work of the industries upon which the success of the war depends.

For the past few years the demand for graduates of engineering schools in this country has been far in excess of the supply, and many of the most important industries have been seriously embarrassed in consequence of this condition. Some of the great industries of America have already made inquiries concerning the possibility of the employment of women in certain branches of engineering work which heretofore have been open only to men.

Many persons who are in a position to appreciate the need for engineers in the prosecution of the war and in the preparation for times of peace which will follow have been concerned over the possibility that the number of students preparing themselves for engineering careers might be decreased as a result of war-time conditions and the action of the draft. In recognition of this possibility, P. P. Claxton, United States Commissioner of Education, under the authorization of the Secretary of War, has addressed a letter to the presidents of the various technical schools and colleges of the United States, as follows:

"The successful prosecution of the war depends in large degree on the services of scientific and technical experts. It is of the utmost importance that the supply of men who have had advanced technical training should not be cut off more than is necessary. In view of this fact, the War Department believes that students in technical schools and colleges who are within the age limits of the selective draft should be treated in the same manner as the workers in the industries which are devoted to the manufacture of war materials. Under this ruling, the presidents of colleges and technical schools may properly urge the district exemption boards to exempt students in their institutions who give promise of special aptitude for the technical and scientific professions until these students have finished their courses. It is expected that institutional officers will exercise due caution and will not claim exemption for students whose success in technical careers is open to doubt.

"It should be clearly understood that each case is to be considered by the district exemption boards on its own merits. Students in technical schools are in no wise exempt as a class. No classes of persons are exempt from the operation of the selective draft except those specified in the act.

"I am bringing this matter to your attention with the authorization of the Secretary of War. The importance of it is emphasized by the inclosed sheet, indicating the small number of available engineers in the country at the present time."

The data inclosed are as follows:

GRADUATES IN ENGINEERING, 1895 TO 1916, INCLUSIVE:

Chemical engineering	1,172
Civil engineering	11,621
Electrical engineering	6,357
Mechanical engineering	11,291
Mining engineering	3,195
Metallurgical engineering	150
Engineering (general)	1,897
Marine engineering	15
Textile engineering	48
Agricultural engineering	31
Total	35,777

Except for the years 1915 and 1916, these numbers include both bachelor's and graduate degrees.

Total number of graduates in engineering in 1895 was 752.

GRADUATES IN ENGINEERING IN 1916:

Chemical engineering	340
Civil engineering	1,236
Electrical engineering	1,098
Mechanical engineering	1,164
Mining engineering	267
Metallurgical engineering	12
Engineering not specified	163
Marine engineering	9
Textile engineering	12
Agricultural engineering	5
Total	4,306

STUDENTS IN ENGINEERING IN 1916:

General engineering	5,485
Chemical engineering	2,774
Civil engineering	7,251
Electrical engineering	7,098
Mechanical engineering	7,707
Mining engineering	1,790
Other types of engineering	1,001
Total	33,106

A HYDROELECTRIC PLANT IS PROPOSED FOR ELEPHANT'S BUTTE DAM.

United States Reclamation Service Will Investigate and Report on Feasibility of Project.

At El Paso, Tex., it is announced by J. M. Lawson, manager of the Elephant Butte Reclamation project, that the United States Government will make a thorough investigation as to the advisability of installing a hydro-electric plant at the big dam, which was completed across the Rio Grande at a point in New Mexico, above El Paso, several months ago. It is roughly estimated that the proposed hydro-electric plant will cost about $1,000,000. It is not the purpose of the government to provide this money, but the sum is to be subscribed by the Water Users' Association who own land embraced in the big irrigation enterprise. This association would have the authority to sell the power to industrial plants and other users.

The high cost of coal here is the primary cause for steps being taken to utilize the water contained in the large storage reservoir created by the Elephant Butte dam in generating electrical energy. It is estimated that the proposed hydroelectric plant will have a capacity of about 40,000 horsepower. In explaining the proposition to large consumers of fuel here, Mr. Lawson stated that the hydroelectric plant that is operated in connection with the Roosevelt Reclamation project in Arizona brings in a total revenue of more than $300,000 annually from power that is sold in different mining districts of that part of Arizona. The hydroelectric plant at the Roosevelt dam is owned by the farmers of the Salt River Valley, who are interested in the irrigation project. It is a very profitable adjunct of the reclamation service.

WASHING-MACHINE MANUFACTURERS DISCUSS TIMELY SUBJECTS.

Material Situation and Shipping Conditions Gradually Improving.

A number of subjects of vital and timely interest occupied the attention of members of the American Washing Machine Manufacturers' Association at the meeting held at the Hotel Sherman, Chicago, July 25 and 26. Among the topics discussed was the government's attitude toward the regulation of steel and iron prices, as disclosed by the conference in Washington earlier in July between the Council of National Defense and the steel manufacturers.

It was agreed by the washing-machine men that there is no necessity for increasing raw-material stocks much beyond the supply of steel and steel products now in warehouses, or that will soon be placed there.

Several members of the Association reported they were still experiencing considerable difficulties, due to a car shortage. Secretary Raymond Marsh presented figures from the American Railroad Association, as evidence that this situation is easing up. He gave instructions on how to file complaints regarding car service with any one of the three committees appointed by the Council of Defense, American Railroad Association and Interstate Commerce Commission. These committees are working in harmony, he reported.

An address on Trade Acceptance by Clarke Washburne, manager of the Credit Department, Federal Reserve Bank of Chicago, was one of the features of the meeting. The secretary reported that many of the members are now using trade acceptances. A discussion on costs and cost systems, under leadership of Howard Power of the White Lily Manufacturing Company, Davenport, was part of the program.

NEW BOOK ABOUT THE SOCIETY FOR ELECTRICAL DEVELOPMENT.

Comprehensive Review of Its Activities—Past, Present and Future.

The all-the-year-round activities of the Society for Electrical Development are pictured and described in 'Aims and Achievements," a review of the Society's work which has just been issued.

The book is a concise, readable digest of what the Society is doing. It describes in terse, simple language its endeavors to combine engineering, publicity, merchandising, advertising and field co-operation for the benefit of its membership and the entire industry.

A graphic chart, which is a feature of the book, separates this work into three divisions—educational work with the public; investigation and educational work with other trades and industries; and trade development and sales promotion work with the electrical industry itself.

In each of these fields the Society is doing certain definite, important work, along lines not duplicated by any other organization. The new book is entirely without any spirit of boastfulness, assuming rather a modest, straightforward style which is convincing.

It is a sincere presentation of the reasons for the Society's existence, giving a clear insight into the constructive work it is doing for its members and the entire electrical industry.

Civil Service Examinations for Engineering Positions.—On September 5, the United States Civil Service Commission will hold an examination for the position of assistant electrical engineer, qualified in municipal research. This is a position in the Bureau of Standards, Washington, D. C., commanding a salary of $1400 to $1800 a year. Applicants for this position must be over twenty years old, and be graduates from an approved college or university. The Commission will also hold examinations on September 4, for the following positions: Heating and ventilating engineer and draftsman, salary $1500; electrical engineer, salary $1500 to $1600 a year; mechanical engineer, $1600 to $1800 a year. Candidates for these latter positions, which are in the office of the supervising architect, Treasury Department, Washington, D. C., will not be assembled for examination, but will be graded on general and technical education, experience and fitness, and submitted drawings. Further details regarding these examinations can be obtained from circulars Nos. 1707 and 1766, respectively, issued by the United States Civil Service Commission, Washington, D. C.

Eminent Domain for Electric Companies Vetoed, Pennsylvania—Governor Brumbaugh, Pennsylvania, has vetoed the proposed law giving public utilities in the state the right of eminent domain. In disapproving of the measure the Governor says: "One objection arises from the fact that the people owning property are denied rights that by this bill are freely bestowed upon definite corporations. The second objection is then important. There are two kinds of corporations authorized by law to distribute electric energy in Pennsylvania, those using water to generate electricity and those using steam power.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

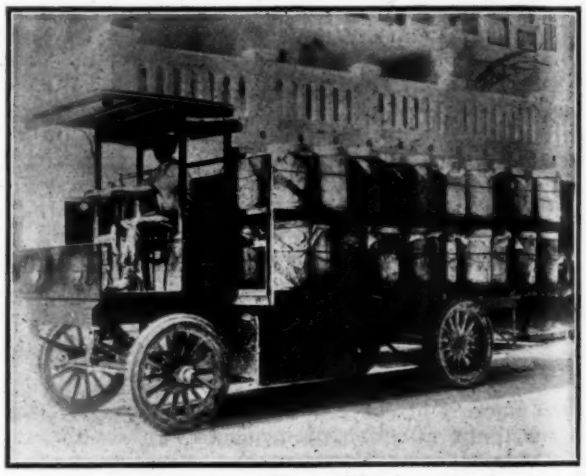
ELECTRIC VEHICLES FOR CITY REFUSE COLLECTION.

Report from Sheffield, Eng., Demonstrates Economy of Electric Over Horse-Drawn Vehicles.

The City of Sheffield (Eng.) made its first experiments with electric vehicles for public street-cleaning work in 1915. It employs more of these vehicles for such service than any other English city. The total fleet is now ten, and the one delivered in September, 1915, has been at work continuously and satisfactorily ever since. J. A. Priestley, the city cleaning superintendent, gave a full account of his experiences in July before the annual conference of the English Institute of Cleansing Superintendents. The features which have proved the electric vehicle to be particularly fit for the class of work referred to were:—(1) That its motive power is always available; (2) The economy of motive power while standing; (3) The ease of starting; (4) noiselessness; (5) fewness of working parts; (6) the ease with which an unskilled man can learn to handle the machine. In work which is made up of stoppages every few yards for loading (2) and (3) are self-evident advantages, while (4) is of considerable importance where night work is carried out; (5) and (6) are readily appreciated by all who know what havoc the war has played with the public service staffs.

Mr. Priestley put his Sheffield experience into the form of figures, but he was careful to point out that no figures could be given which could be applied like a mathematical formula to any and every district. His figures related to Sheffield conditions and to the relative cost of "horse haulage" and "electric vehicles" under those conditions. Describing what those conditions were, he said he knew of no place where conditions relating to bin refuse collection were less favorable to the use of motors than in Sheffield. On the other hand the opportunity of using the vehicle on both day and night service was a decided advantage as it divided the standing charges over two shifts, although such charges were necessarily increased by working double time. With horse wagons for house-to-house collection from portable bins there are two men, a driver and a laborer and both help to load. With electrics there are three laborers, and a driver who only loads occasionally. In each case the laborers accompany the vehicle to tip. Horse wagons collecting from ashpits, both wet and dry, are loaded by the driver alone, and "electrics" by the driver and one laborer. The wages of "getters-out" of refuse from the ashpits do not come into the comparison. The working costs of the electrics include (1) wages, (2) vehicle costs, (3) tires, (4) electricity. The first item is the actual amount paid during the period under review. The second includes (a) interest and depreciation based on ten years' life, (b) insurance, (c) garage, watering, cleaning and charging, (d) waste, oil, grease, etc., and (e) repairs and renewals. The third is the actual cost under a maintenance contract, and the fourth is the amount charged against the vehicles for the current supplied. The five items together amount to $1032 or $19.08 per week divided equally between day and night work. Mr. Priestley considers that the ten years' estimate is not too optimistic but is fully justified for the following reasons:—

(1) One-half the cost of the vehicle is represented by the battery, and this is guaranteed to give 100 per cent of its original efficiency after eight years' constant service, and any defects not due to misuse are made good by the makers during such period. If a battery will do this at the end of eight years' service it is not unreasonable to expect a further two years' working life. . . . In America there are batteries in use after even longer periods of service.



Electric Refuse Truck Used in England.

(2) The electric vehicle cannot be compared with steam or gasoline vehicles as there are fewer working parts. There are no boilers, cylinders, valves, cranks, pistons, clutches or gears, all of which are liable to quick wear. The life of a vehicle with fewer parts to wear must necessarily be longer.

(3) The electrical drive subjects the vehicle to very much less strain and shock in starting or speed changing.

(4) The provision for repairs and renewals represents about ten per cent on the cost of the chassis, less battery and tires, and allows, therefore, for complete renewals of the entire machine, less these items, in the ten years' period.

(5) Although the vehicles are used for both day and night service the total mileage per week is very low, and nearly one-half of this mileage is run without load. On this basis, therefore, ten years' life does not represent hard service.

The figure which Mr. Priestley included for repairs and renewals in the above total is based on experience

with the first vehicle and is more liberal than appeared necessary with the later ones.

In the year from March, 1916, to March, 1917, during which five electrics were in service for periods varying from one year to three months, 51,494 tons of bin refuse were collected by horses at a cost of $1.31 per ton, and 7040 tons by electrics at a cost of $1.16 per ton. Of ashpit refuse 27,877 tons were collected by horses at a cost of $0.89 per ton, and 10,670 tons by electrics at a cost of $0.53 per ton.

In these figures the comparison of cost is between horse and labor and electrics over the whole city of Sheffield, but inasmuch as the electrics with one exception were working on the longest distances, this basis is not strictly fair to the electrics. As additional motors were put in service these replaced horses on long distances, with the result that the horse costs over the city area have decreased while electrics remain at a maximum.

The result of twelve months of electric vehicle working at Sheffield considered on a financial basis alone is eminently satisfactory. Put shortly, 3½ vehicles working for one year have cleared off more than the entire initial cost of 1½ vehicles. If the comparison was made for electrics and horse vehicles working in the same district exactly, the saving would be materially increased.

For those concerned in the horse value of electrics the author gave the following table relating to the whole city but the number of horses actually replaced by each vehicle is a fraction under six:—

	Bin refuse	Ashpit refuse	Total
Average tons per day—horses	3.42	3.63	
Average tons per day—electrics	7.67	10.58	
Value of each electric in horses	2.24	2.91	5.15

Brooklyn Campaign Results in 1918 Iron Sales.

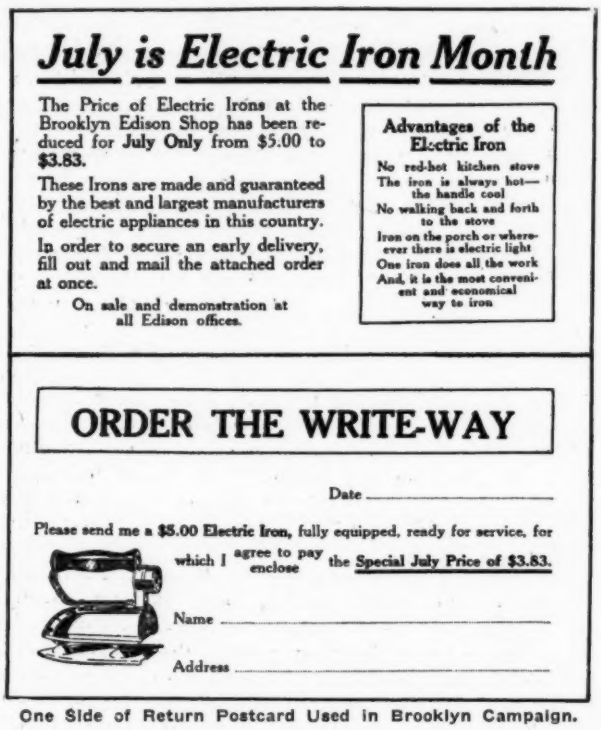
The annual July electric flatiron sale by the Edison Electric Illuminating Company of Brooklyn resulted in 1,918 sales. A standard $5.00 iron was featured at a special sale price of $3.83.

In commenting on this campaign, H. W. Wells, advertising manager of the company, states, "this total beats all previous records for a sale of the same duration, notwithstanding the fact that the price was over 50 per cent higher than last year, and also that we had a sale in March of 1,066—making our 1917 total of irons in special sales 2,984.

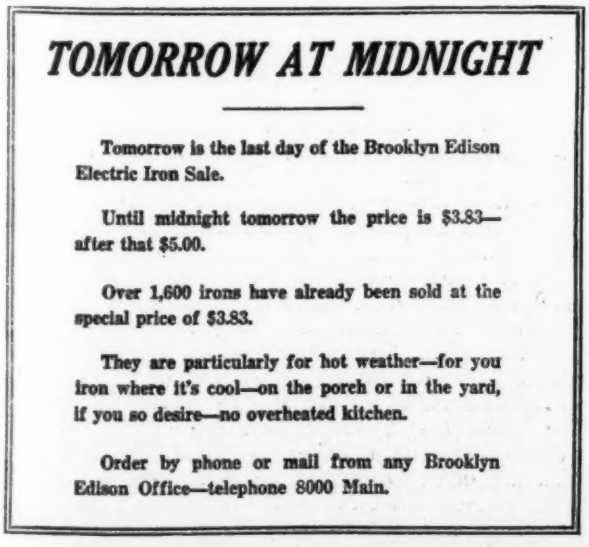
"We feel proud of this record, first, because it beats our best previous mark and secondly, because the results were obtained through the honest efforts of the entire sales force aided by our usual post card with the bills to residential customers.

"On the last two days of the sale we ran last minute notices in the newspapers which resulted in 120 orders on July 30, and 305 on July 31—a real whirlwind ninth-inning finish."

The accompanying illustrations show the two newspaper advertisements used on the last two days of the sale, and also one side of the return post card sent to customers.


July is Electric Iron Month
The Price of Electric Irons at the Brooklyn Edison Shop has been reduced for July Only from $5.00 to $3.83.
These Irons are made and guaranteed by the best and largest manufacturers of electric appliances in this country.
In order to secure an early delivery, fill out and mail the attached order at once.
On sale and demonstration at all Edison offices.
Advantages of the Electric Iron
No red-hot kitchen stove
The iron is always hot—the handle cool
No walking back and forth to the stove
Iron on the porch or wherever there is electric light
One iron does all the work
And, it is the most convenient and economical way to iron
ORDER THE WRITE-WAY
Date
Please send me a $5.00 Electric Iron, fully equipped, ready for service, for which I agree to pay enclose the Special July Price of $3.83.
Name
Address

One Side of Return Postcard Used in Brooklyn Campaign.


TOMORROW AT MIDNIGHT
Tomorrow is the last day of the Brooklyn Edison Electric Iron Sale.
Until midnight tomorrow the price is $3.83—after that $5.00.
Over 1,600 irons have already been sold at the special price of $3.83.
They are particularly for hot weather—for you iron where it's cool—on the porch or in the yard, if you so desire—no overheated kitchen.
Order by phone or mail from any Brooklyn Edison Office—telephone 8000 Main.
Until 12 Tonight
The Brooklyn Edison special July sale of Electric Irons at $3.83 closes to-night at midnight.
Telephone orders received at the Company's switchboard (Main 8000) up to 12 o'clock to-night or mail bearing a July post-mark received at any of the Company's Offices will be honored at the special rate price.
To-morrow these Irons will be sold at $5.00.
To-Night's the Night

Two Advertisements Which Stimulated Sales on Last Days of Campaign.

KILLING INSECTS BY ELECTRICITY—A NEW OPPORTUNITY FOR THE SALE OF ENERGY.

By R. L. Montgomery.

Mosquitoes and other insects are so prolific in many localities that the tranquillity of the summer night is spoiled, ofttimes it is impossible to sit outside at night unless protected. The state of affairs has become such that whole communities have clubbed together to eradicate the insect scourge by every means possible.

In one of the many popular tourist resorts the mosquito and other insects of the night had made night life unbearable, had in fact so infested the locality that the guests at the hotel were unable to sit out on the veranda at night, except where screens were installed. The proprietor of one of the hotels, alive to the seriousness of the situation, and being wide awake, decided if steps were not taken to overcome the scourge of insects his trade would dwindle. He was a wide-awake man and had noticed, in fact he could, unfortunately, not help having noticed, that the insects were attracted by the lights of the hotel, and the brighter the light the greater seemed the attraction for the insects.

He had heard it was best to do things electrically so he decided to try catching the insects electrically. Procuring a 100-watt tungsten lamp and projector he set them up so that the rays went into the night at a comparatively low elevation, such as the insects of the night ordinarily frequent. Close to the lamp and projector and at their base a motor-driven blower was installed and at the outlet end of which a cage or bag of metallic gauze such as is used for fly screens was fastened. The motor driving the blower or exhaust fan and the lamp were connected to the same switch so that turning on the one also turned on the other.

When nightfall came the insect catcher was turned on and left on until after the guests had retired. Next morning an examination of the container showed that about one gallon of insects of all sorts and sizes had been caught. The success of the insect catcher was undeniable; the hotel proprietor thought it phenomenal because it enabled his guests to be left in peace. Of course its success depended upon the light of the projector or catcher being more intense than that of the remainder of the veranda, so that the insects were effectively lured to their doom.

The man utilizing the electric insect catcher also uses a large electric sign for attracting attention to his hotel. He is very proud of his sign, but prouder still of his insect catcher. He boasts that he uses electricity to catch his trade and his insects too. He is an enthusiast for doing things electrically.

The possibility of the electric lamp and fan or blower surely is most encouraging for insect killing. Every year newspapers tell of municipalities spending large sums in oiling waters and taking other steps to prevent the breeding of the numerous insects; each year government papers and other authorities give out figures to emphasize the enormous loss to crops and vegetation and discomfort to persons due to insects. Every insect killed before it breeds represents a very true extermination. Oil waters by all means, but allow the electric fan and the electric light to co-operate. When referring to swating the fly, usually one swat kills but one fly. But the fan and the light performs wholesale swating, that is at once effective and economical. Do it electrically.

Big Gains in Power Business at Atlanta.

During the past 30 days the Georgia Railway & Power Company, Atlanta, Ga., has secured 3900 horsepower in new power business. This establishes a new record for the company. The business is divided among eight companies whose annual consumption will aggregate 6,770,000 kilowatt-hours.

The companies involved are as follows: Buckeye Cotton Oil Company, 1200 horsepower; Atlantic Steel Company, 800 horsepower; Walton Cotton Mill Company, 800 horsepower; Palmetto Cotton Mills, 600 horsepower; Marietta Mining Company, 185 horsepower; The Massachusetts Mills, 165 horsepower; L. G. Neal, 100 horsepower; and Southern Leasing Company, 50 horsepower.

The Buckeye mill contract is in addition to 3,500,000 kilowatt-hours a year that the company already was using for the operation of their de-linting plant. The addition was made in the form of a single unit of one 1200-horsepower motor, which is to be directly connected to the main oil-mill shaft by flexible coupling. The complete electrification of these two plants is regarded as a big victory for central-station power, as central-station service now will replace a very economical cross-compound steam engine and will be demanded 24 hours a day during the oil-mill season. The mills will continue using steam for cooking seed.

The Massachusetts Mills, at Lindale, will use power for their new dyehouse. This company contemplated installing a steam turbine, but decided that purchased power was more advantageous.

The Palmetto mills contract was signed on the basis of increase in production with lower manufacturing cost per pound of output, and also to secure more economical power and greater flexibility in driving the several departments through the adoption of motor drive.

The Marietta Mining Company contract is for power to operate that company's pyrites mine located a couple of miles out of Marietta. Houston and Liggett, Lewisburg, Tenn., are the owners. This development is in line with the recent urging of Secretary of the Interior Franklin Lane, that pyrites ore properties be worked to their fullest in all parts of the country, in order to furnish materials for fertilizer and munitions manufacture. Pyrites is a compound of sulphur with copper and iron. Georgia has a large quantity of this ore.

Electric Power Company Makes Extension to Serve Oil Wells.

San Joaquin Light & Power Company, Fresno, Cal., has spent close to $1,000,000 since the beginning of 1917 on extensions to serve the oil fields of that state. In new transmission lines 700,000 pounds of copper have been used. The oil companies have spent large sums on equipment for electric pumping. The Union Oil Company recently contracted with San Joaquin company for 100-horsepower for driving compressors, having changed from steam to electricity at a number of wells. The San Joaquin company is now serving power at 1500 wells. It is reported that contracts have been made to serve 200 other wells, which cannot be put in effect by reason of the lack of transformers. It is estimated that these electrical installations cost about $500 per well, which is 80 to 100 per cent lower than gasoline and steam equipment. These changes, from gasoline and oil to electricity, are due principally to the high prices of oil and oil products, and the comparatively low cost of electric energy.

Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Useful Hints for the Wireman and Operating Electrician.

By Maurice J. Moriarty.

In working among electricians of industrial establishments and among the wiremen of electrical contracting concerns, it is surprising to find many men, even experienced journeymen, doing work in roundabout ways, wasting material and turning out inferior jobs. This is due chiefly to ignorance of short-cut methods, although frequently one finds a workman who is simply careless or lazy. Since both materials and labor are exceptionally expensive now, it may be of value to mention at random some hints to improve these conditions.

Testing Rheostat for Open Coil.—A very handy and simple testing device for rheostats is a watchcase telephone receiver of low resistance connected in series with two dry cells. When testing from coil to coil a click will be heard if the connection is continuous. If the coil or the connections between the coils are open, no click will be heard. An investigation of this coil and its leads will then quickly disclose the trouble.

Rheostat-Magnet Protection.—On direct-current motor rheostats the black cloth covering over the release magnet is frequently found so loose that the fine magnet wires are exposed to dampness and corrosion. When you find a case of that kind, use a piece of black oil cloth, the kind motors are covered with in shipping. Cut a piece the proper size to cover the wire surface and make a tight glued joint. Be careful in spreading the glue to keep it off the magnet wire. This makes a neat job. For an emergency job a good quality tape may be used, but as a rule it is difficult to apply it neatly.

Sawing a Slate Panel or Switch Back.—When a mechanic has a job of slate sawing to do which calls for a clean and even edge with an ordinary coarse-tooth saw this hint will be of great assistance. Mark the section to be cut off with a sharply pointed awl. Mark the lines with the awl two or three times so as to have a sharp, straight and fairly deep cut for the saw to be guided by. By sawing through this cut surface splinters and a poor job can be avoided.

Mica for Electric Range Repairs.—In repairing electric ranges a repair man frequently meets with insulation difficulties. The trouble is generally found underneath the heating unit at the point where the lead wires are connected to the unit. The trouble is caused by the gradual deterioration of the wire insulation, causing grounds or shorts. Repairs of a permanent nature can be made by covering the wires at that point with mica sleeves and holding the sleeves in place with a good quality of heating-unit cement.

Wood Chisel-Handle Protector.—In old-house work a wireman has to use wood chisels of various sizes quite extensively. To prevent splitting the wood handles of these chisels, I have great success by fitting a so-called Crown Tonic bottle cap on the handle of each chisel so that it will not loosen by hammering. This plan has been the means of saving many chisel handles.

Clean-Edged Holes.—When boring a hole in wooden desks or tables in mounting signal or telephone devices, good work should be the first consideration. Rough-edged holes show up the workman. To avoid rough-edged holes, withdraw the bit as soon as the worm shows through, then start the bit worm through from the other side. By following this plan in boring a hole both edges will be clean and smooth.

Raising Dents in Woodwork Made by Tools.—Dents made by misdirected hammer blows or tool operations in old-house work, telephone cases, instrument boxes, etc., can be raised and resurfaced as follows: Pour enough alcohol or gasoline on the dented spot to just cover it, then light the alcohol or gasoline carefully and let it burn. The heat of the flame will expand the wood, raising it higher than the original surface if the dent is not too deep. The raised surface can be sandpapered or chiseled to a smooth surface and finished in color to match the rest of the surface.

Cleaning Wall Paper.—An electrician may have the misfortune when installing switches in fine residence work to mark the wall paper. The mark on the paper can usually be removed by carefully using a pencil eraser. If this does not remove the mark entirely, mix up four ounces of ordinary flour and one-half ounce of 90 per cent ammonia and one-half ounce of water; mix into a dough. Roll this mixture over the mark on the wall paper and this will almost invariably take up the dirt.

Mounting Fixtures.—When going to a job to hang nxtures it is well to carry an assortment of three-eighths-inch couplings and three-eighths-inch nipples. With these a uniform fixture support can be made in outlet boxes that are not flush with the finished surface. Where the outlet boxes are flush with the finished surface the coupling and nipple can be dispensed with and the fixture fastened to the outlet-box hickey directly.

Applying Soldering Paste.—For applying soldering paste to joints, terminals, etc., a brush similar to the kind given with bottled mucilage is very handy. With such a brush the amount of paste to be applied can be varied to suit the requirements of each soldering job and none is wasted.

To Facilitate Boring Large Holes.—When boring holes in hard pine timber, with bits of one inch and above, a great deal of trouble is experienced due to the worm of the bit being gummed up and losing its pulling power. By rubbing the worm of the bit with soap or oiling same, if soap is not handy, it will be found that the bit will bore through without any trouble. J. H. Lamoureux.

The Sparking of Brushes and Heating of Commutators

Numerous Special Cases of Sparking and Commutator Heating Due to Insufficient Contact Drop or Improper Brush Position—Setting Brush Position on Interpole Machines—Overloading Machines

By E. H. MARTINDALE

Manager, and Member of Board of Directors, A. I. E. E.

This is the eleventh of a series of 14 articles on the solution of commutator and brush troubles. The series began in the issue of March 24 and appears at intervals of two weeks. The earlier articles of the series were devoted to brush characteristics and a general discussion of commutation troubles followed by a detailed consideration of many of the principal difficulties. The remaining three articles will deal with other important commutation problems and their remedies.

THE most common trouble encountered with the operation of brushes on motors and generators is sparking or heating. There are many causes for both, as given in the outline of troubles published in the fourth article of this series, which appeared in the issue of May 5, 1917.

One of the most frequent causes of sparking and heating is in having the brushes not set on the electrical neutral, which permits short-circuit currents under the brush faces. Another cause of sparking and heating from short-circuit currents is thick brushes spanning too many bars. Brush studs not parallel with the commutator bars, non-uniform assembly of brushes on the brush studs or incorrect brush spacing may result in sparking and heating due to short-circuit currents. All of the above causes were fully discussed in the ninth article of the series, in the issue of July 14.

If the brushes cannot move freely in the holders due to dirty holders and brushes or due to too large brushes, the pressure of the brush on the commutator may not be sufficient to maintain good contact, which will result in severe sparking and generally cause high mica. The same trouble will be caused by weak brush-holder springs. The proper brush tension was discussed in the third article of the series, in the issue of April 21.

Sparking and Heating Due to Improper Contact Drop.

Short-circuit currents resulting in sparking and heating may be caused by the use of brushes with a too low contact drop. It is a very common and natural occurrence for an electrician to think he wants a brush of higher carrying capacity because the brush he is using gets hot. The line current is very seldom enough to overheat any standard brush and the heating will in nearly all cases be due to chattering of brushes (see article in the July 28 issue), too low brush pressure causing poor brush contact, too high brush pressure with high-friction brushes, or to short-circuit currents. If the pressure is correct and the brushes are not noisy, the chances are that short-circuit currents are the cause of the heating.

The carrying capacity of a brush is determined almost wholly by its contact drop and coefficient of friction. A high-contact-drop, low-friction brush may have a higher carrying capacity than a low-contact-drop, medium-friction brush. If, therefore, the heating is due to short-circuit currents, the desirable brush is the high-contact-drop, low-friction one. This low friction means the brush can have no abrasive or cleaning action. If sparking is present, it may, therefore, be necessary to undercut the mica to secure good operation.

If the mica is allowed to become high with any brush, the sparking and heating will be severe and the brush wear rapid. If the mica tends to become high, it should either be undercut or kept flush with the commutator surface by the use of sandpaper or a commutator stone. The latter is strongly recommended, as it will remove any flat spots and keep the commutator round.

Sparking and Heating on Commutating-Pole Machines.

Short-circuit currents resulting in sparking and heating sometimes occur due to poor adjustment or design of a commutating or interpole winding. An interpole incorrect by 10 per cent is far worse than none, because the iron in the interpole offers such a good magnetic path that the flux from the main poles and from the armature magnetizing action through the commutating field under the interpole becomes greater than if the interpole was not present. This should not be taken as a criticism of interpole machines in general, as the writer believes this to be one of the biggest improvements of recent years. The interpole has not only increased the permissible output from the same amount of copper and iron and made the direct-current motor more flexible, but it also has made practicable in fairly large sizes the single-phase commutating-type motor, which is rapidly coming into favor where an alternating-current motor is desired with the characteristics of the direct-current series motor.

Directions for Setting the Brush Position on Commutating-Pole Motors.

The spacing and setting of brushes on commutating-pole motors is extremely important. A displacement of one-sixteenth-inch from the correct position is often sufficient to cause the motor to spark badly and to have very unusual and erratic speed characteristics.

The brushes of the commutating-pole motor must

not be shifted as those of ordinary motors frequently are in a comparatively careless and off-hand way. The brushes of such a motor must be set exactly after a careful test and thereafter should not be changed. No man can tell by looking at a motor equipped with commutating poles where the brushes should be set. It is practically impossible tc tell where to set brushes by noticing the sparking because the place where the sparking is satisfactory may be so narrow and the mechanical conditions affecting commutation may be so bad that even a trained man will not be able to tell by this means where to set the brushes.

The commutating-pole winding is connected in a certain direction compared with the armature winding and this connection should never be altered. One side of the commutating-pole winding is connected to one side of the armature. When the direction of rotation of the motor is to be reversed, the free end of the commutating-pole winding and the free side of the armature are reversed. The connection between one side of the commutating-pole winding and one side of the armature should never be changed. If these directions are not followed there is a great likelihood of reversing the relation between the commutating-pole winding and the armature. This will cause bad sparking and bad speed-efficiency characteristics.

It is rather difficult to understand the method of setting the brushes on a commutating-pole machine and close observation is required in order to distinguish the indications which show where the brushes should be placed. These conditions are entirely different from those found in machines not equipped with commutating poles.

The flux from the commutating pole should divide equally, one-half going to one side of the brush and the other half to the other side. When this is the case, the commutating-pole flux does not affect the speed of the motor but only affects the commutation. If the flux does not divide equally on either side of the brush, the motor changes its speed with changes in load or direction of load. It also sparks more or less badly and may have a very bad efficiency.

Probably the best way to set brushes on a commutating-pole machine is to run it as a series motor, using the armature and commutating poles only, the main field coils being entirely disconnected. When the brushes are set so that the flux is divided equally on both sides, the motor will not rotate and there will not be any torque tending to produce rotation. An armature resistance will have to be used to keep the current down to about twice full-load current. When the brushes are just about in the right place, the amount of torque may be so small that it will not actually produce rotation, but the torque can be felt by turning the pulley around by hand, noticing whether or not it turns harder in one direction or the other. The brushes must be so accurately set that there is no torque in either direction when twice full-load current is flowing through the armature and commutating poles.

Another way to set the brushes on a commutating-pole machine is to run it as a motor at no load in first one direction of rotation and then the other, using the armature commutating poles and main poles. When the brushes are so set as to give exactly the same speed at no load in both directions of rotation with a constant line voltage, it means that the brushes are in the neutral portion of the main field. If the commutating poles are spaced exactly in the center, between the main poles, the brushes will also be located correctly for the commutating poles. If the commutating poles are connected in the wrong direction or if the magnet circuits are not perfectly symmetrical, this method will not give correct setting.

Another way to set the brushes on a commutating pole machine is by the use of a low-reading voltmeter, the zero point of which is in the center of the scale. The motor is operated at no load or under any load, but preferably, it should be operated somewhere from half to full load. Two terminals leading from the voltmeter and spaced about five-eighths-inch apart are placed on the commutator and moved around it from a short distance behind the brush to a short distance in front and the position of the neutral is noted by observing when the reading of the voltmeter is zero. Many times the neutral will be found under the brush, but frequently it will be found to shift from one side of the brush to the other, depending on the direction of the rotation, the direction of the load, and the position of the brushes. The correct setting is exactly halfway between two positions, obtained by running the motor in first one direction and then in the other with exactly the same load, speed and voltage and other conditions. The brushes will have to be within one-eighth-inch of the right place before any accurate test of this kind can be made, otherwise the position of the brushes will distort the neutral so that the true neutral will not be shown.

How to Overload a Machine Safely.

In these times of increased production and long delays in getting electrical equipment it is frequently necessary to heavily overload a motor or generator for a few months. In such cases everything possible should be done to save the machine by reducing the heating. See that all the bearings are clean and well oiled, check up the air gaps and brush spacing carefully. See that the brush pressure is high enough to maintain good contact, but not high enough to cause excessive friction; undercut the mica and use a low-friction brush as recommended by a carbon-brush manufacturer.

If with all these precautions the heating is still dangerous, place a fan to blow air through the machine in the same direction as the natural windage. This can be determined by blowing smoke into first one end and then the other to see whether the smoke travels from the rear toward the commutator or from the commutator toward the rear. If there is no natural windage, place the fan to blow from the rear toward the commutator as the heated air passing through the machine will be less injurious to the commutator than the heated air passing over the commutator will be to the windings. On some machines this can be accomplished by placing home-made fan blades on the shaft.

Excessive sparking due to loose end connections or an open circuit in a coil were fully discussed in the issue of June 16. Sparking due to unequal air gaps caused by unequal length of pole pieces or worn bearings were discussed in the issue of June 2.

The most important causes of sparking and heating have been covered or referred to in this article, while other minor causes have been discussed elsewhere in this series.

Among the Contractors.

The Martien Electric Company, Illuminating Building, Cleveland, O., has been awarded the contract for all the electrical work in a large garage being built at Seventeenth Street and Lakeside Avenue, Cleveland.

The Carroll Electric Company, Washington, D. C., has been awarded the contract for electrical work in a new store building to be constructed at 714 Eleventh Street.

The Dealer and Storekeeper

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

ELECTRIC FANS PROVE USEFUL IN DRYING FRUITS AND VEGETABLES.

Department of Agriculture Advises Use of Electric Fans for Promoting Conservation of Food Supplies.

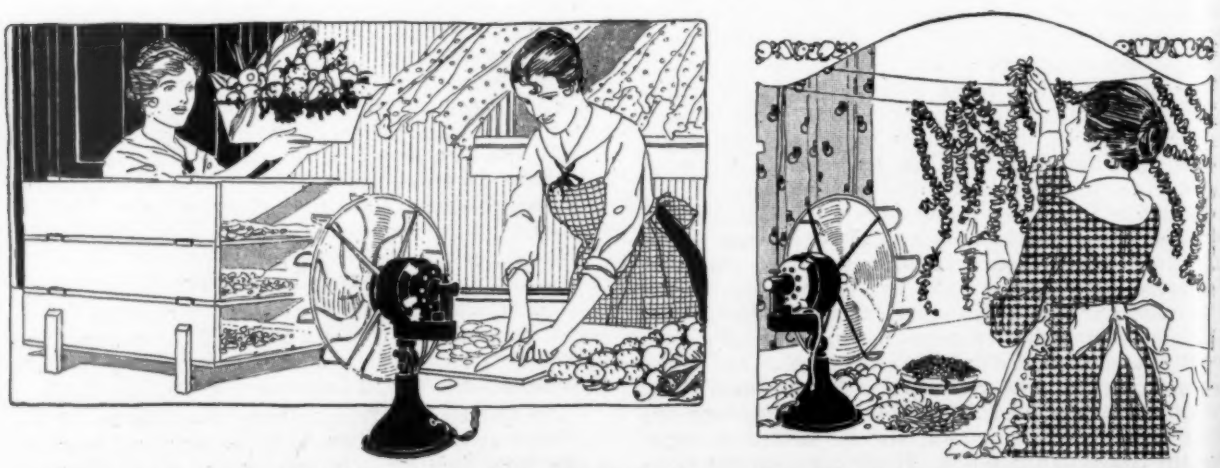
In a recent bulletin (No. 841) issued by the United States Department of Agriculture, official endorsement is given to the use of electric fans for drying fruits and vegetables. The agitation conducted last spring for extensive and intensive gardening so as to increase the available food supply, both of this country and its allies, has produced a large volume of vegetable and fruit products. Since most of these are of perishable character, their most logical employment will be in preserving as much as possible for future use. Usually this is done in the well known methods used by the housewife for generations, but difficulty arises at the present time due to the scarcity of jars and other containers usually employed for preservatives. This, combined with the high price of sugar, will tend to make preserving rather expensive along the old lines.

The Government has, therefore, through its Department of Agriculture, advocated the drying of fruits and vegetables. In order to do this properly a certain amount of care and skill is required, but these are easily developed. A copy of bulletin No. 841 can be obtained free by writing to the Division of Publications, Department of Agriculture, Washington, D. C. The bulletin says:

"It has been found that many sliced vegetables and fruits placed in long trays 3 by 1 foot and stacked in two tiers end to end before an electric fan can be dried to the requisite dryness within 24 hours. Some require much less time. For instance, sliced string beans and shredded sweet potatoes will dry before a fan running at a moderate speed within a few hours. In many cities the electric fan will cost not more than one-fourth of a cent an hour to run. The fan should be placed close to the stacks of trays, and they should not be filled so full that the air can not pass freely through them. The fan method has a marked advantage in that the product keeps cool owing to evaporation while it is being dried, thus tending to retain the color and eliminate spoilage."

This is a very strong endorsement of the use of electric fans for this purpose and, in fact, opens practically a new field of application for this familiar appliance. To call attention to this new use of fans, the Society for Electrical Development is co-operating with the Department of Agriculture and with numerous women's magazines and newspapers everywhere to urge the drying of fruits and vegetables with electric fans. It is supplying numerous short articles for use in such publicity work and also supplying advertising copy and cuts for insertion in local newspapers by central-station companies and dealers of fans. Two of these cuts are reproduced herewith and show the different methods that can be used for drying the products by means of the fan. It is felt that this will open a large avenue of usefulness for this well established household appliance, and at the same time furnish a good market for local dealers and central stations.

Will Spend $2,000,000 on Equipment.—Federal Shipbuilding Company, the new subsidiary of the United States Steel Corporation, is to construct ten shipways of wood, a 1000-foot dock, fourteen buildings for shops and other utilities. The sum of $6,000,000 will be spent on the plant, of which $2,000,000 will be for equipment. E. H. Gary is president of the company, with Robert MacGregor as vice-president and general manager. A great deal of electrical equipment will be required.



Two Methods of Drying Vegetables and Fruits Quickly by Aid of Electric Fan—First Using Superposed Trays with Screen or Cheesecloth Bottoms—Second Hanging Sliced Products on Strings or Threads.

When an Electrical Contractor is a Good Competitor

A Frank Statement of How Several Contractors Unwisely Bid on Work With Which They Were Unfamiliar

By R. A. WILSON

THERE was a certain printer in a Middle Western city who added an engraving branch to his establishment and had need of an oven which would generate a high heat. This called for installation of an air compressor, suitable connection with a gas supply, etc., to create the effect of "blow-pipe heat." Power was to be electrical. So the printer called up an electrical contractor to come and figure on the job.

The first sent an estimator who took a look at the situation, made some measurements, asked a lot of questions and departed. Next day he returned and took some more measurements. On the second day he was back with the results and indicated to the printer that the motor would have to be hung from the ceiling, belted to the compressor, etc., etc. The estimate was $227.

That was much more than the printer figured on having to pay, so he tried another man listed in the back of his telephone book as an electrical contractor. This second contractor came in person, repeated the course of the first as to taking measurements and asking questions, etc., and in a day or so reported that the first requisite would be a special type of motor which would run the cost higher than the figures of the first man.

These two estimates had the printer wondering whether he had better not stay out of the engraving business, but he called a third contractor, also listed in the telephone book. This man came, sized up the situation; telephoned for the motor salesman to give him an estimate. The motor salesman drove over, and he asked a lot of questions and then gave an estimate. There was the gas pipe to be run and changed. The electrical contractor had a pipe-fitting estimator to come and ask his list of questions, clutter up the print shop and use up a lot more of the printer's time. This proceeding was repeated six or eight times more, even to calling on a glazier to come and say what it would cost to cut a hole through a piece of wire-glass to let a gas pipe through. That bid was the highest of the three.

The Reward of Honesty.

Then the printer, who saw the time flying and that he was getting nowhere, began to think of giving the whole thing up, or turning to some other method of getting the heat he wanted. He did, however, conclude to give the thing one more trial and called a contractor named Jenner. There is a "Jenner" in every community. Jenner came and the printer began to tell him what he wanted. Jenner interrupted him by saying:

"I am no electrical engineer, and what I don't know about gas and air compressors would furnish you more copy than all your printers could set up in one thousand years. You don't want me. I am a house-wiring contractor. You want somebody like Farwell or Mason. They can fix that job up in a hurry. Much obliged for giving me the chance, though, but it isn't in my line."

So this printer, after he had carefully put the card of the house-wiring contractor away in a file labeled "Worthy People," presently called Farwell. The old man himself was in and answered the call. He heard the printer's story of what he wanted, sized the situation up, sat down at the printer's desk and made some hieroglyphics on a scrap of paper. Then he made one telephone call and reported to the printer that the job would cost, complete and ready to throw the switch, $107, with the chance of its being scaled down to $102 if he found he had enough of a certain material and did not have to buy it on the advanced market. He got the job and went at it, finishing things up in half a day. He tucked motor, compressor and everything else under a composing stone and put a switch on the wall beside the little furnace—it was not an elaborate job—and the printer became a full-fledged engraver and happy. Meanwhile the printer-engraver had told Farwell of his troubles and named all the contractors who had figured on the job.

All of them were members of the local organization of electrical contractors. Every one of them was undertaking to do something that he knew nothing about They could have taken blueprints, probably, and could have worked out the installation, but they were not qualified to design. The first three of them not only did not get the business, but they queered themselves with the printer named, and he likely will tell the story at the next meeting of the Ben Franklin Club in his town. They probably knew they were figuring on something that was not in their line, only, instead of doing as Jenner did, they undertook to get the business and make what they could out of it.

The best competitor in the whole outfit was Jenner. He knew it was not in his line and he said so, instead of puddling around and muddying up the water for everybody else in the field. Jenner is a specialist in house wiring. If the printer had merely wanted his lighting system revised, Jenner could have made the calculations necessary very readily. But when he was offered something that was not in his line he did the wise thing and the thing that a good competitor should do—he passed it on to somebody who was prepared and equipped and manned to handle it. He took away with him the good will of the printer and has done something that reflects credit on the electrical contracting personnel of his community.

Specialization a Good Policy.

"If you are not big enough to specialize in two or three things," commented one of the veteran contractors who discussed the incidents just related, "specialize on one. It will pay you, but it will hurt you and the rest of the concerns in the industry unless you do stick to your last."

An illuminating engineer is one thing, this con-

tractor observed, and a house-wiring contractor is an altogether different thing. Both may be the very best there are in their own lines and yet, when either comes to getting into the territory of the other, the chances are that he will flounder around and muddy up the water until, though the prospect can be led up to the pond time after time, he can hardly be forced to drink of it. A contractor who can install any number of motors in any kind of a plant and turn out a job that will recommend the electric drive tremendously does not become, by the same token, an electrical engineer.

"When a factory owner calls me up to come out and see what is the matter with a motor," said the same contractor, "I do not send the same man who goes out to estimate a job of house wiring. Instead, I send the specialist in my force who is a motor man. If I sent my purchasing agent, or my sales manager, or my illuminating engineer, I would certainly be messing things up. The chances are that none of the others would be able to figure out what was the matter or that he would diagnose the case properly. In a new installation I would have use for three of these men, the sales manager, to sell the installation, the engineer to specify and the purchasing agent to run the costs. If I sent the wrong one he would very likely underestimate the cost and leave me with a loss, or overestimate it and lose me the job.

"A group of contractors each specializing in a particular line are much like one contractor with several lines. The general results are much the same, if the one big contractor sends the wrong man out to a job, or if the wrong contractor tries to land the job for which he is not fitted. In the first case the penalty would fall on the one big business; and in the second it would be distributed throughout the group. In the first case the head of the big business would be proving himself a poor business man; in the second the unfitted contractor bidding on a job not in his line would be proving himself a poor competitor."

Report of Portland Railway, Light & Power Company.—The annual report for 1916 of the Portland Railway, Light & Power Company filed with the Public Service Commission at Salem, Ore., shows that large interest charges consumed the profits made by the company during the year, but substantial net revenues are shown on its miscellaneous operations. The income for the year on railway operations amounted to $3,277,288, while its railway operating expenses amounted to $2,017,387, leaving a net revenue of $1,259,901. Taxes chargeable to railway operations amounted to $275,751, reducing the operating income to $984,150. Non-operating income amounted to $1,385,289, making a gross income for this department for the year of $2,369,439. Deductions from the gross income amounted to $2,430,610. The chief item making up this sum is the interest on the funded debt, amounting to $1,936,896. The loss in this department for the year is given at $61,170. In miscellaneous operations the report shows the income from light and power was $1,960,184, while operating expenses were $772,273, leaving a net revenue of $1,187,911. The company realized for the sale of water power the sum of $145,456 with operating expenses of $5,843. The entire income for all the miscellaneous operations including the two given above aggregated $2,164,674. Total operating expenses were $810,957, leaving a net revenue of $1,353,716. Against this taxes to the extent of $297,495 are chargeable.

Figuring Profits and Pricing.

It has been stated, with authority, that only about 10 per cent of American manufacturers and merchants know their actual costs of doing business, and this percentage applies equally to electrical dealers.

There are very few who could not profit by a thorough study of this important phase of electrical merchandising. And at this present time of extreme effort for higher efficiency, under the stress of high and fluctuating costs, the matter of figuring profits and establishing selling price is of utmost importance.

Let us take, for example, the merchant who sells for $3.75 an article that costs him $3. A case is cited where such a dealer contended that he was making a net profit of 5 per cent; that it cost him 20 per cent to do business and that he was selling at an advance of 25 per cent.

This is clearly a mistake of not distinguishing between advance on selling price and advance on costs. In the instance mentioned, the selling was at an advance of 25 per cent on the cost, but he figured his cost of doing business on the selling price. He made 75 cents on this article, but it cost him 20 per cent to cover selling expenses, and this should always be figured on the selling price. The exact amount of gross profit on the article would be 20 per cent of $3.75, or 75 cents. This dealer was not making a net profit of 5 per cent as he supposed; he was just breaking even!

Percentage advance on cost and selling price are vastly different. An advance of 25 per cent on cost is only 20 per cent on selling price; 33⅓ per cent on cost is only 25 per cent on selling price—and so on.

Every dealer should make absolutely sure that his profits are figured correctly. There are many ways of getting at the right result. As a matter of concrete example and handy reference, the table given here will be found of good service, covering the wide range of from 5 per cent to 50 per cent profit on the selling price.

How to Proportion Profit on Selling Price to Cost

The Electrical Dealer's Rapid Method Table

To make:		
5% on selling price add	5.263%	to cost
6% on selling price add	6.383%	to cost
7% on selling price add	7.527%	to cost
8% on selling price add	8.696%	to cost
9% on selling price add	9.89%	to cost
10% on selling price add	11.11%	to cost
11% on selling price add	12.36%	to cost
12% on selling price add	13.63%	to cost
13% on selling price add	14.94%	to cost
14% on selling price add	16.27%	to cost
15% on selling price add	17.64%	to cost
16% on selling price add	19.04%	to cost
17% on selling price add	20.48%	to cost
18% on selling price add	21.95%	to cost
19% on selling price add	23.45%	to cost
20% on selling price add	25%	to cost
22% on selling price add	28.2%	to cost
24% on selling price add	31.58%	to cost
25% on selling price add	33.33%	to cost
28% on selling price add	38.9%	to cost
30% on selling price add	42.85%	to cost
33⅓% on selling price add	50%	to cost
35% on selling price add	53.846%	to cost
40% on selling price add	66.67%	to cost
50% on selling price add	100%	to cost

Table For Figuring Profit.

BOOK REVIEWS

"American Hydroelectric Practice." By William T. Taylor and Daniel H. Braymer. New York: McGraw-Hill Book Company. Cloth, 439 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Monadnock Block, Chicago, for $5.00.

This book is admittedly a "compilation of useful data and information" relating to hydroelectric systems in America. The authors make no claims to having produced a text book on design, but they have collected together particulars and descriptions of existing hydroelectric systems and greatly increased the value of such information by stating the underlying principles and essential features of design, construction and operation. Whole pages, and even sections, are reproduced verbatim from the original sources, particularly from the *Electrical World*, but the selections have been made with judgment, and the book as a whole is a wonderfully well balanced and useful work of reference.

Both hydraulic and electrical problems and practice are dealt with, and the ground is well covered except that the design and construction of dams and the very large generating and substation buildings are subjects that have been entirely omitted. It is not possible, however, to cover adequately in one volume all subjects of interest to designers of hydroelectric power developments, and with few exceptions the material included is, in the reviewer's opinion, exactly what one would look for in a book of this kind.

The question of costs and economic considerations generally has, very properly, been treated at considerable length. The ground covered may briefly be summarized as follows: General survey of water-power engineering; illustrated descriptions of a large number of typical hydroelectric stations; selection of plant equipment; transmission-line construction and operation; costs and economics of plant, line and substations; steam-auxiliary operation and economics; discussion of special problems, such as selection of insulators, telephone troubles and protection schemes. The final chapter contains useful data, reference tables and system diagrams, also a reprint of the very useful data relating to the principal high-tension transmission systems of the world operating at pressures over 70,000 volts.

In choosing material to be incorporated in this book, the authors might perhaps have made wiser selections in one or two cases. For instance, the method of calculating sags and stresses in overhead conductors is taken from an article in the *London Electrical Review*. No unfavorable criticism of the methods advocated by the author (E. V. Pannell) is possible, but factors of safety as used in England are included in the calculations, and British practice in such matters can be of no possible interest to American engineers, who, after all, were the pioneers and are now the experts in this particular branch of electrical engineering. If British engineers are compelled to use a factor of safety of 5 in calculating the permissible sags of overhead conductors, that is because they are hampered by legislation and somewhat arbitrary or unreasonable regulations which have more or less consistently stood in the way of a healthy and moral development of the electrical industry in England, but such figures are somewhat misleading in a book relating to American practice.

A notable and commendable feature of the book is the entire absence of half-tone illustrations. Line drawings are used throughout, thus obviating the necessity of using paper with a highly glazed surface and showing clearly, in diagrams and cross-sections, what could not be presented so exactly and with sufficient detail in any other way.

ALFRED STILL.

"Electrical Meters." (Second Edition.) By C. M. Jansky. New York: McGraw-Hill Book Company. Cloth, 416 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Monadnock Block, Chicago, for $3.00.

This work, of over 400 pages, is a thorough and quite complete treatise on instruments for measuring electricity. As would be expected from this author, the subject is treated entirely from an engineering and not from a historical standpoint. No attempt is made to cover foreign makes of instruments which are little used in this country, or those formerly manufactured here, which have become obsolete.

The fundamental electrical principles and units, on which electrical measurements depend, are discussed quite fully, and, in turn, the theory and construction of the different classes of instruments used for this purpose. The explanations are given in a clear and elementary way and can be followed in large measure by a person without technical education, although the mathematical formulae are given when needed to prove the theory under discussion. Separate chapters cover indicating ammeters and voltmeters, power measuring, phase relation and frequency instruments, recording or graphic meters, integrating ampere-hour and watt-hour meters, and demand meters. A large number of the instruments now in commercial use are described, the chapter on watt-hour meters in particular being quite complete in describing present makes of meters.

The latter part of the work consists of chapters on testing the different classes of instruments, methods of obtaining different power-factors, instrument errors and instrument transformers. Necessarily, the material in these chapters is largely compiled from authoritative sources; the chapter on instrument errors is stated to be adapted from a bulletin on "Testing Electrical Measuring Instruments," issued by the Bureau of Standards, and from other sources. Some of these authorities, however, are not readily available for the student or general reader, and these chapters are valuable in bringing together information on these subjects in a comprehensive way.

The maintenance and commercial use of instruments is not taken up to any considerable extent, so that the work is not sufficiently complete to constitute a manual for the practical operation of meters and instruments, and evidently was not prepared with this in view. It will be found, however, a valuable reference work for anyone interested in electrical measurements.

O. J. BUSHNELL.

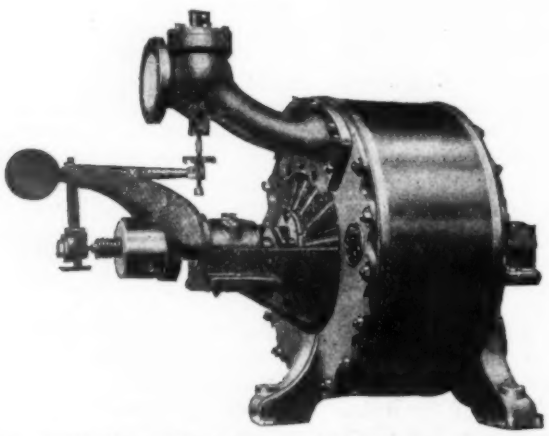
New Jersey Electric Contractors Hold Semi-Annual Meeting—The Electrical Contractors Association of New Jersey held its midyear convention at Pleasure Bay, July 14, with headquarters at Price's Hotel. A large delegation from different sections of the state attended, making the affair a pronounced success. Following the business session, a number of interesting addresses and talks were given by the different members. A clam bake was given in the evening.

New Electrical Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Curtis Steam Turbine for Driving Fans, Blowers and Pumps.

The General Electric Company, Schenectady, N. Y., has developed a Curtis steam turbine in a wide variety of capacities to drive fans, blowers and pumps for

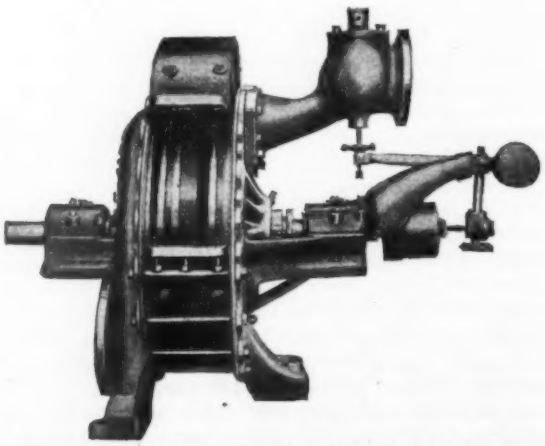


New Curtis Steam Turbine for Driving Pumps, Blowers and Fans.

boiler feeding and circulating systems in power plants, breweries, paper mills, on shipboard, etc.

It is called the type L and is of the impulse type. The number of stages and rows of buckets vary with the capacity. The principles used and mechanical practice evident in the construction are the result of the best experience of the manufacturer in producing turbines for practically every class of service.

A split wheel casing is used to permit ready inspection of the buckets, which are of bronze securely dovetailed into the rim of the wheel. The exhaust steam from the turbine is free from oil and is well suited for heating feed water.



Curtis Type L Steam Turbine, Showing Split Casing.

Speed regulation is close and reliable and the speed may be changed by handwheel adjustment while the turbine is in operation. A constant running speed is maintained by a simple and powerful speed governor mounted directly on the shaft and controlling a double balance piston valve-type throttle.

The main shaft carrying the turbine and governor runs on babbitted bearings with renewable linings, and is fitted with readily accessible packing glands.

Three feet support the rigid frame of the turbine to insure the bearings always being in line. The wheel casing is neatly lagged with planished iron.

Link-Belt Electric Hoists.

The Link-Belt Company, with factories in Chicago, Philadelphia and Indianapolis, and sales offices in the principal cities of the country, announces its ability to again furnish Link-Belt monorail electric hoists for quick shipment. These machines are made at the Philadelphia plant where a large additional building is rapidly nearing completion and the already excellent manufacturing facilities are being greatly increased. Fig. 1 shows a collection of type C-1 machines in the Assembling Department. Two types, C-1 and C-2, are furnished, the safe lifting capacities ranging from 1,000 to 6,000 pounds. They can be adapted for either direct or alternating current and fitted with plain,

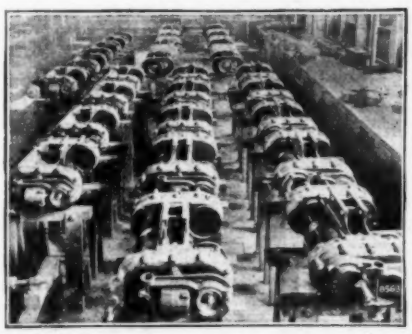


Fig. 1.—Assortment of Link-Belt Monorail Electric Hoists Assembled Ready for Shipment.

hand-geared, cord-operated motor, or a cage-operated motor trolley.

There is now an unprecedented demand for electric hoists. Practically every industry is working at top-notch capacity and electric hoists are helping to expedite production. Entrance of the United States into the war served to increase the use of such labor-saving appliances, taking the places of men who are called to the front.

It is claimed that the Link-Belt hoist is the first monorail machine to employ a dynamic-braking system for controlling the lowering speed. Dynamic lowering provides the variable-speed control that is so

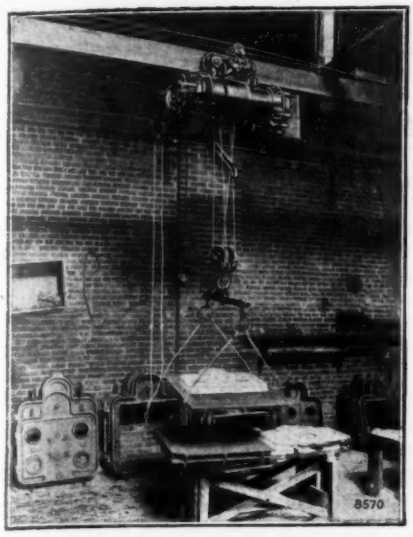


Fig. 2.—Link-Belt, Direct-Current Hoist in Use in Foundry.

essential in many places. Some of the other good features of this hoist are the small amount of headroom required; weather and dustproof construction; accessibility of working parts; simplicity and ruggedness of hoist gearing; automatic oil-bath lubrication; renewable bronze bushings throughout, and "safety-first" construction.

Fig. 2 shows a direct-current, plain-trolley hoist handling boiler cores in a foundry before they have been baked. Fig. 3 shows a hoist handling pulleys in a pulley-manufacturing plant. Other machines are working in ice plants, machine shops, automobile-manufacturing plants, boiler houses, paper mills, steel plants, coal tipples, etc. One paper mill is using eight C-1 machines for handling rolls of paper; another

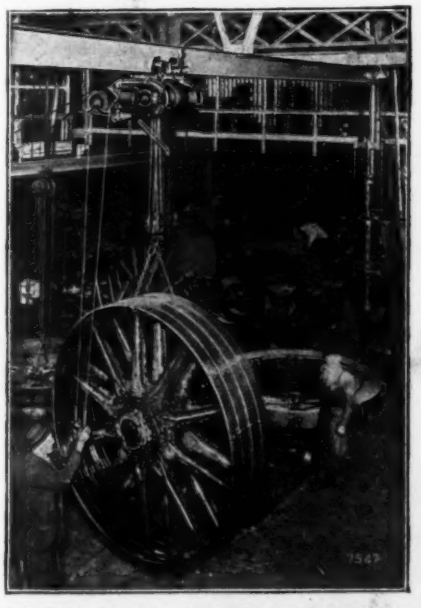


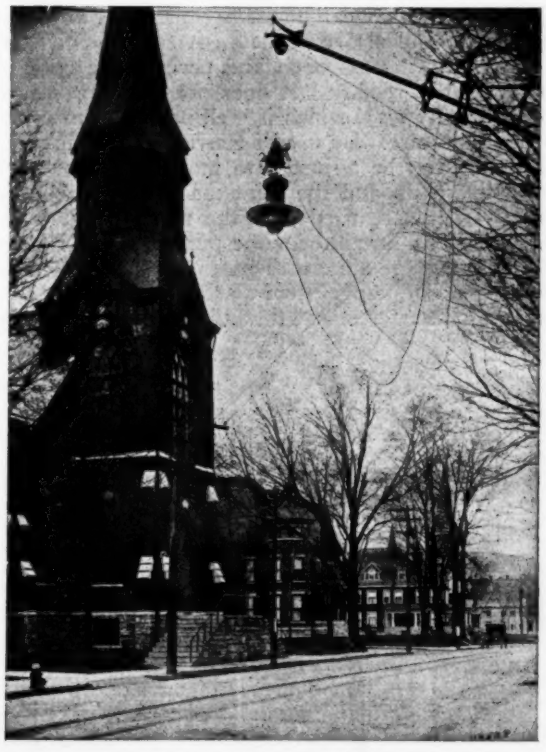
Fig. 3.—Link-Belt Electric Hoist in a Pulley-Manufacturing Plant.

employs a cage-operated hoist for handling ashes from boiler room to cars; while others are using them for handling cars of wet pulp, casks of clay and miscellaneous materials.

New Street-Lighting Fixtures for New York Town.

In order to modernize its street lighting and to provide fixtures whose appearance should be in keeping with the natural beauty of the streets, the Oneonta Light & Power Company has recently installed 121 new Luxsolite fixtures in Oneonta, N. Y. This Catskill Mountain town has a population of 10,000 and is justly proud of its attractive, well shaded streets.

These fixtures, manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., are equipped with 600-watt Mazda C lamps and Holophane skirted refractors. This is the latest modification of the band type of refractor, which is in turn a modification of the bowl type. An objection to the bowl —that it gives poor illumination immediately under the fixture—is overcome by using merely a band. This redirects the same light from above the light center as the bowl type. At angles of 80 degrees and over with the vertical, direct light is given since the fila-



New Luxsolite Fixture for Street Lighing in Oneonta.

ment extends slightly above the refractor itself. Hence the unit is a source of glare which may be so trying to the eyes that the over-all effectiveness is cut down. To overcome this defect a satin-finished skirt has been applied to the band, which reduces the dazzling brilliancy near the horizontal without greatly interfering with the other characteristics of the unit. Maximum light flux is given out at an angle of 80 degrees with the vertical—the usual value for street-lighting units.

Adjustable Electric Light Fixtures.

For use in offices in general and especially in bookkeeping departments and drafting rooms, where fine detail must be examined; in clothing shops where dark goods are being sewed; in machine shops and assembling plants, where light is frequently needed for

Typical Adjustable Bracket Fixture.

illuminating interior parts of machines, and in other cases the need often arises for a convenient, rugged and adjustable light source. This calls for a strong lighting fixture that can be readily adjusted and it is to meet this want that the American Fixture Company, 232 West Water Street, Milwaukee, Wis., has placed on the market a line of what are known as American adjustable electric light fixtures, on which patents are pending.

These fixtures consist of a comparatively small number of standard hollow parts, made of sheet steel, strongly welded and with special jointed ends by means of which they can be readily turned or adjusted to any angle and also extended. A special universal joint is used which is open and permits the cord to pass through it readily. It does not pinch or injure the cord in any way, which is well protected in every part of the fixture. By use of convenient thumb-nuts, these joints can be adjusted to move freely or they can be drawn up and the joint made rigid. Special dished washers are used with the nuts and give the greatest possible friction for the purpose. The fixture parts include large and small bases, spreaders, combination base and taper stem parts, extension pieces from 6 to 36 inches in length, and arms ranging from 3 to 21 inches in length; there are also special joints of large and small sizes, and the necessary nuts, screws and washers. A total of 36 pieces covers every detail necessary for making up any length and style of fixture from 6 inches to 9 feet. In accompanying illustrations are shown a typical wall bracket and a ceiling fixture. These cuts give an idea of the flexibility of this line of fixtures, which can be used for wall brackets from 6 inches to 4 feet long, ceiling fixtures from 5 to 10 feet in length, floor fixtures of any desired length, and bench or table fixtures with simple or double arms and stand of almost any length.

This shows that these fixtures meet all the requirements for a quickly adjustable and self-sustaining direct light in practically any position conceivable. They may have as many as nine or even more adjustable joints, permitting the light to be brought around very irregular obstructions; as a rule three joints afford all the adjustment needed. The base for the fixture has holes for screwing it to the wall, ceiling, floor, bench, table, or post.

Pipe or Wall-Mounting Brackets for Panel-Mounting Oil Circuit-Breakers.

Frequently a user will have a spare panel-mounting circuit-breaker that will just fit his need in a new installation except that he must mount it on the wall or on a pipe frame, or a standard breaker for panel mounting may fit the requirements of capacity and method of trip better than the standard pipe or wall-mounting breaker. To enable the panel-mounting breaker to be mounted on the wall or on a pipe frame, the Westinghouse Electric & Manufacturing Company is making a line of special brackets.

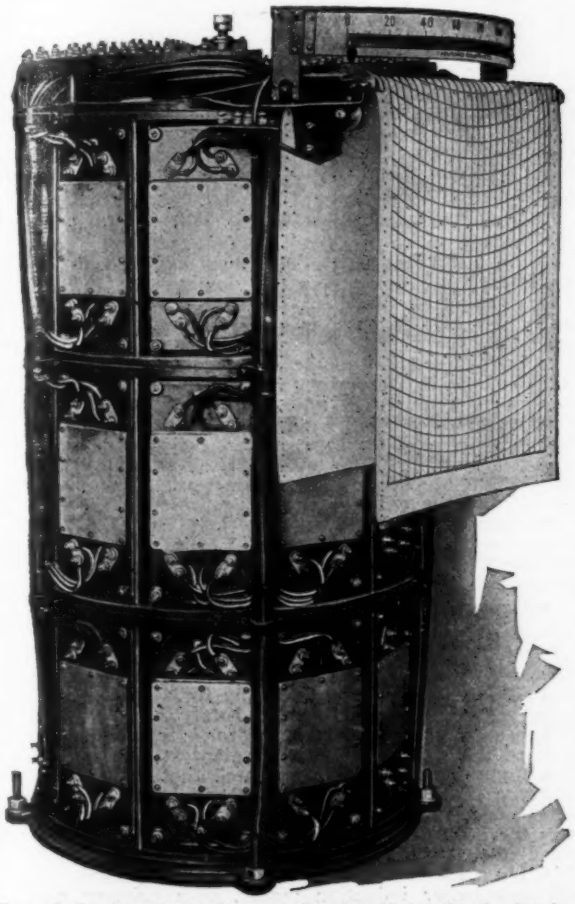
Typical Adjustable Ceiling Fixture.

Wall-Mounting Bracket for Oil Circuit-Breaker.

Largest Totalizing Graphic Meter in the World.

Great strides have been made in the design and construction of graphic recording meters in recent years, but no one would have conceived it possible but a few years ago to meter the output of a group of 30 generators, each rated at 7,500 kilowatts and aggregating a maximum capacity of about 250,000 kilowatts. An instrument for this very service has, however, recently been put into use and its successful construction and operation mark a distinct achievement in the art.

This meter was designed and built by The Esterline Company, Indianapolis, Ind., for installation at the famous Keokuk hydroelectric plant of the Mississippi River Power Company. This plant now has an equipment of 15 generators of the size referred to and is designed for an ultimate capacity of 30 of these machines. The meter is intended to make a graphic rec-



View of the Completed Largest Graphic Meter Ready for Installation. Each Plate Covers a Pair of Meter Elements. The Case Is Dust-Tight Throughout.

ord of the total output of the plant, regardless of whether it is operated in sections or as a gigantic single system. A special type of curve-drawing instrument was therefore required, greatly beyond the capacity of anything ever attempted in this line before. The specifications required a high degree of accuracy, freedom from appreciable errors on varying voltage, frequency, power-factor and temperature, with a degree of damping which would prevent overshooting. The instrument is designed so as (1) to enable the operator to have the proper number of generators on the line for the load being carried; (2) to make an accurate record of the ouput of the plant, giving information relative to growth of business, load-factor, variation of load with seasons of the year, days of the week and hours of the day, relative night and day output, peaks, periods of low load, etc., all of which is of the greatest value in shaping the policy of the management, the making of rates, determining costs, etc.; (3) to obtain a record of the frequencies and duration of station and line troubles and the performance of the plant under such condtions.

To meter the output of 30 three-phase generators required the use of 30 polyphase meter elements, each made up of two single-phase units. In carrying out the design of this instrument, the desirability of using the same general design in other instruments was borne in mind, with the result that the supporting frame was made up of three superposed sections, each carrying ten polyphase meter elements, thereby making it possible to construct a similar instrument of ten elements or any multiple of ten to fifty. The instrument is designed so as to be self-contained, without the use of an external case, and is arranged so as to enable the removal and calibration of any individual meter element without putting the instrument out of operation.

The induction type of meter element was adopted, after having devised an element capable of being calibrated mechanically for torque without affecting the correction for power-factor. The moving element consists of six aluminum vanes, all mounted on a single staff, supported in such a manner as to eliminate friction completely. The use of this type of element entirely eliminated moving connections or contacts and made possible a high ratio of torque to pen friction.

All connections are carried to the top of the instrument to a circular terminal board carrying 240 binding posts, four being used for each single-phase meter element. The actual width of chart is 12½ inches. The charts used are printed in 12-hour sections and fed at the rate of 3 inches per hour over two rollers, one of which carries pins for driving the paper and is rotated by means of a solenoid-operated ratchet connected in the electric clock system of the plant. The indicating scale, which faces the system operator's desk, is illuminated and graduated to the same range as the chart.

The instrument is installed in one section of a semicircular benchboard which partially surrounds the operator's desk, so that the illuminated scale and the printed portion of the chart are at all times in full view of the operator.

The order for this instrument was placed in April, 1916, the design was completed, preliminary tests made, the instrument constructed and installed and put in operation in February, 1917. The ruggedness of the instrument is evidenced by the fact that it was completely assembled and calibrated, shipped to Keokuk and installed, without affecting the calibration.

With an instrument of this type it is possible to totalize the output of a station of any capacity, or a number of stations or systems, regardless of differences in frequency or voltage, and whether or not they are in synchronism. Instruments can be built for any number of circuits from 5 to 50.

Important Power Station Is Destroyed by Fire. —It is reported that Olive Lake hydroelectric station of Eastern Oregon Light & Power Company, in the vicinity of Sumpter, Ore., has been destroyed by fire. As a result, Sumpter and other towns in that part of Eastern Oregon are without lights, and several gold-mining dredges and lode mines in the Sumpter district are without power and light and are compelled to shut down.

Activities in the Trade

Link-Belt Company, Chicago, Philadelphia and Indianapolis, has a new electric-hoist catalog on the press and will be glad to send copies to interested parties upon request.

The Electric Service Supply Company, Philadelphia, Pa., has awarded a contract for the construction of a new three-story brick and concrete factory at Seventeenth and Cambria Streets, to John L. Gill & Company, Otis Building.

W. A. Carrell & Company, Pittsburgh, Pa., who make a specialty of buying, selling, renting and exchanging power equipment, report a greatly increased business. This company was established in 1912 and has been obliged to increase its facilities a number of times owing to its steady growth.

Chelten Electric Company, 314 Armat Street, Philadelphia, announces arrangements with Hight & Stout, 143 Liberty Street, New York City, for that firm to handle its New York account. This firm is well established and well known to the trade. Mr. Hight formerly was New York representative of Weber Electric Company, and Mr. Stout was formerly with the Bryant Company.

United States Graphite Company, Saginaw, Mich., has issued a booklet giving information relative to its Mexican boiler graphite as a remedy for scale in steam boilers. Two hundred letters from users of this material are given as testimonials, including those in charge of power plants in numerous industries. Clean boilers and greatly decreased costs are claimed as the result of using Mexican boiler graphite.

Kilbourne & Clark Manufacturing Company, Seattle, Wash., will move this month into larger quarters containing one acre of floor space, extending from Railroad Avenue to the waterfront on Connecticut Street. The larger quarters are to afford room for greater facilities for manufacturing wireless apparatus and equipment, for which the company has contracts amounting to $1,600,000. The new plant will have various departments, including machine shop, brass foundry, forging shop, stock rooms and warehouse, and offices for different departments and for government inspectors. The entire plant will be equipped with modern facilities for using electric power. The number of employees will be increased from 125 to about 400 men.

Crocker-Wheeler Company, Ampere, N. J., has issued Bulletin No. 181, in good form for office files, in which its motor-generator sets are illustrated and described. The cuts used are clear and expressive. The machines described comprise the synchronous motor, direct-current generator; induction motor, direct-current generator; direct-current motor, direct-current generator; synchronous motor, alternating-current generator; induction motor, alternating-current generator; and direct-current motor, alternating-current generator. In illustration of direct-current motor-generator set, the flexible coupling is shown. A frequency changer, consisting of two synchronous machines, operating at different frequencies, is also shown. The bulletin is full of interest to those using electrical equipment of the combination types referred to.

The Elliott Electric Company. Cleveland, Ohio, recently secured the contract to equip the coal mine owned by the Interstate Mining Company near Carrollton, Ohio. The contract covers complete electric power equipment, including generator, motors, ventilating fans, cages, pumps and 25 miles of transmission lines. The Elliott Company specializes in supplying the electrical needs of industrial plants. It has been in the field 28 years and claims to be the only Cleveland house equipped to furnish every electrical need of an industrial company. Four years ago M. C. Ripple became treasurer and general manager, W. H. Seldon, Jr., president, and E. J. Bonswor, secretary, since which time the business quadrupled. The company is sales agent for General Electric motors. Last fall Mr. Ripple foresaw the conditions which would prevail in the motor field this year and contracted for nearly $200,000 worth of motors. As a result the Elliott Company is in splendid shape to meet any demand for motors.

General Electric Company, Schenectady, N. Y., is to play a big part in the building of the world's largest hotel, the Commonwealth, soon to rise 28 stories in the Times Square district of New York, under the supervision of Charles E. Knox, a prominent consulting engineer. The electrical equipment for power will be sufficient for a city of 20,000 inhabitants. Not only the electrical apparatus for the lighting, heating and ventilating of the monster hostelry, but the electrical devices for operating and controlling the machinery used in the kitchen, laundry and refrigeration departments, the pneumatic-tube service, vacuum-cleaner system, and the various pumps necessary in a building of the Commonwealth type will be furnished by the General Electric Company. This company will also furnish the electrical conduits, wires, cables, and incandescent lamps for this hotel. The Hotel Commonwealth will occupy an entire block-front in the heart of New York's shopping and amusement centers. It is to contain 2,500 rooms.

British Thomson-Houston Company, Limited, London, England, in its July report, shows that profits for the past year, after deducting all expenses and charges, other than interest on debentures and loans, were $1,796,821, as compared with $1,311,805 for the previous year. The amount brought forward was $366,795, less $350,000 required for excess profit duty and munitions levy and for increased depreciation to the end of 1915. A reserve of $125,000 made in December, 1915, for raw materials, not having been required, is now written back. There is to be appropriated $768,500 for depreciation, as against $724,390 last year. Carried forward, subject to deductions of munitions levy for 1916, is $819,615, as against $366,795. Within the last year J. F. Nauheim resigned as chairman and E. Thurnauc, who for 21 years represented the French shareholders, has retired. C. A. Coffin and E. W. Rice are re-elected directors, and H. C. Lewis, managing director, becomes chairman. Balance sheet shows $5,544,120 due General Electric Company of New York.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, has received orders recently for steel mill equipment which accentuate present demands for increased productive capacity. One of such orders was from Atlas Crucible Steel Company for a 450-horsepower wound-rotor induction motor, a rotary converter and a 130-horsepower direct-current motor, for installation as standard rolling mill drive in its plant at Dunkirk, N. Y. This apparatus is so interconnected that at heavy loads the rotor currents supply power through the rotary converter for the direct-current motor, which, in turn, helps drive the mill. The Westinghouse Company also has received an order from the Brier Hill Steel Company, Niles, Ohio, for a 132-inch plate mill equipment, consisting of a 5000-horsepower induction motor, with primary control panel and step regulator; a 24-inch reversing roughing mill, with a 7600-horsepower direct-current motor, and a 2250-kilowatt, 3000-horsepower motor-generator set with a 60,000-pound flywheel; and an 84-inch plate mill equipment with a 2500-horsepower induction motor, primary control panel and slip regulator. Other equipment ordered for the same plant includes two 750-kilowatt synchronous motor-generator sets and four 3500-kilovolt-ampere radiator-type transformers. The Nevada Consolidated Copper Company ordered for its mines at Ruth, Nev., complete electric hoisting equipment, consisting of a 400-horsepower Westinghouse type CW wound-rotor induction motor, with control equipment, comprising liquid controller with electromagnetic switches. The Consolidated Gas & Electric Company, Baltimore, also placed an order with Westinghouse Company for two 22,000-kilovolt-ampere turbogenerators to operate at 13,200 volts, three-phase, 25 cycles; also two 32,000-square-foot condensers. This company likewise ordered four 1200-kilovolt-ampere and one 1750-kilovolt-ampere Westinghouse transformers, to furnish additional power to industrial plants in the vicinity of Westport, Md.

Latest Approved Fittings

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

Attachment Plugs, Fuseless.—The Arrow Electric Company, Hartford, Conn.

"Arrow E," 660 watts, 250 volts, "Standard," catalog No. 8300; base, catalog No. 8200; caps, catalog Nos. RA, RB, RE, RG; adapters, catalog Nos. RC, RJ.

Listed June 22, 1917.

Chain-Extension Attachments.—The Arrow Electric Company, Hartford, Conn.

Consist of extended arm fastened to interior of socket, receptacle or side-outlet switch, and support a pivoted lever attached at ends to pull chain and operating cord.

"Arrow E," catalog Nos. 8545, 8546.

Listed June 29, 1917.

Cleaning Machines.—Clements Manufacturing Company, 601 Fulton Street, Chicago, Ill.

Portable motor-driven suction cleaning machines (vacuum cleaners).

"Reliable," model No. 22; "Cadillac," model No. 17; "Little Ben," model No. 30; "Big Ben," model No. 8; all 200 watts or less, 110 volts, alternating current and direct current.

Listed June 29, 1917.

Conduit Boxes.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

"National" pressed-steel conduit boxes.

Concrete boxes, catalog Nos. 3300, 3301, 3311, 3319, 3399, 3400, 3401, 3411, 3419, 3499, 3500, 3501, 3511, 3519, 3599, 3700, 3701, 3711, 3719, 3799.

Cover plates for concrete boxes, catalog Nos. 2848, 2849.

Listed June 11, 1917.

Conduit-Box Fittings, Covers.—The Arrow Electric Company, Hartford, Conn.

Porcelain covers for conduit boxes as rosettes, catalog Nos. 1797, 1798.

Brass covers for mounting receptacles, catalog Nos. 459, 460.

Listed June 22, 1917.

Current Taps.—The Arrow Electric Company, Hartford, Conn.

"Arrow E," multiple type, keyless, 660 watts, 250 volts, catalog No. 8208.

Series type, keyless, 660 watts, 250 volts, catalog No. 8209.

Listed June 22, 1917.

Cutout Bases, Plug Fuse.—Barber Electric Manufacturing Company, North Attleboro, Mass.

"Barber," 0-30 amperes, 125 volts, catalog Nos. 1935, 2135, 2165, 2199, 2569, 2587, 2965, 8042.

Listed June 19, 1917.

Fixtures. — The Albert Sechrist Manufacturing Company, Denver, Colo.

Fixtures covered by label service.

Listed June 15, 1917.

Fixtures. — The Albert Sechrist Manufacturing Company, Denver, Colo.

"Sechrist Patent Electroliers." Straight electric fixtures having standard bodies and stock arms of various patterns, designed to be readily wired and assembled. Arms and stems are made of either round or square tubing.

Listed June 15, 1917.

Fixtures, for Use with Gas-Filled Lamps.—The Albert Sechrist Manufacturing Company, Denver, Colo.

Fixtures for use in accordance with Rules 35*a* to 35*d*, inclusive, of the National Electrical Code.

Listed June 15, 1917.

Fuses, Plug.—Multi Refillable Fuse Company, 703 Fulton Street, Chicago, Ill.

Non-refillable Edison plug fuses, 3-20 amperes, 125 volts. "Multi."

Listed July 10, 1917.

Heaters, Air.—Majestic Electric Development Company, 428 O'Farrell Street, San Francisco, Cal.

Portable air heaters, consisting of wire-covered resistance elements mounted on sheet-metal reflectors and inclosed in sheet-metal casing with screened fronts. 5.6 amperes or less, 110 volts, type No. 8.

Listed June 15, 1917.

Heaters, Air.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

"Cozy Glow," 500 watts, 100 to 250 volts, style No. 181425.

"Square" type (type B) luminous, 500 to 2000 watts, 100 to 250 volts; style Nos. 102900-B, 102901-B, 102902-B, 225131, 225132.

Listed June 22, 1917.

Heaters — Cooking Appliances.—Globe Stove & Range Company, Kokomo, Ind.

Ranges, hot plates and ovens, 10,000 watts or less, 110-220 volts, type E.

Listed June 29, 1917.

Musical Instruments—Action for Pipe Organs.—The Rudolph Wurlitzer Manufacturing Company, North Tonawanda, N. Y.

Electric action for pipe organs. A 10-volt, self-excited, ungrounded generator, belted to a blower motor, sends current thorugh a series of manually operated switches in console and an electropneumatically operated relay to corresponding magnets in the organ-controlling air valves. The generator is fused at its terminals with standard fuses. Standard rubber-covered wire runs from generator and as common return from organ to console. Special silk-insulated cable protected by asbestos covering runs from console to organ.

The electrical portions of this equipment are judged to be as well safeguarded as can be demanded in an instrument of this type. Before installation, inspection department having jurisdiction should be consulted.

Listed June 26, 1917.

Panelboards.—General Electric Company, Schenectady, N. Y.

Dead-front panelboards, built up of units consisting of a knife switch and cutout base for cartridge inclosed fuses, live parts on back of panel inclosed in case of sheet metal and grillwork, and fuses accessible from doors in front of panel only when switch is in "off" position.

"G.E." Safety First switch panel.

Listed June 15, 1917.

Picture Machines, Stereopticon Type.—Frank L. Olson, 3147 South Park Avenue, Chicago, Ill.

Motor-operated, automatic lantern-slide device, using a 500-watt incandescent lamp and inclosed in a sheet-metal case.

"Oleson's Automatic Stereopticon," 525 watts or less, 110 volts.

Listed July 10, 1917.

Receptacles for Attachment Plugs, and Plugs.—The Arrow Electric Company, Hartford, Conn.

"Arrow E," 660 watts, 250 volts, catalog Nos. 8204-07 inclusive, 8212, 8219, 8229-31 inclusive, CA1 to CA36 inclusive, CA-59, CB-201 to CB-236 inclusive, CB-259, CC-901 to CC-958 inclusive. Plugs, catalog Nos. RA, RB, RE, RG. Adapters, standard to Edison, catalog Nos. RC, RJ.

With link-fuse bases, 2 amperes, 125 volts, catalog Nos. CA38, CB-38.

Plugs, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 1714.

Listed June 26, 1917.

Receptacles for Attachment Plugs, and Plugs.—Peerless Light Company, Halsted, Adams and Green Streets, Chicago, Ill.

"Peerless" flush receptacle, Edison type, 660 watts, 250 volts, catalog No. 1708.

Listed June 15, 1917.

Receptacles, Medium Base.—John I. Paulding, New Bedford, Mass.

"Paulding" porcelain-shell receptacles. Keyless, catalog No. 2758.

Listed June 19, 1917.

Personal and Biographical

T. S. KEMP succeeds A. L. Chase as manager of the electric light plant at Clarendon, Texas.

W. O. HAYMOND now has charge of the Muncie Electric Light Company's plant at Muncie, Indiana.

ROBERT MACGREGOR, marine engineer, has been made vice president and general manager of the Federal Shipbuilding Company.

I. B. SHEPHERD recently was appointed general manager for the Etowa Power & Light Company of Tennessee, succeeding W. H. Price.

J. H. PRIOR, formerly chief engineer of Illinois Public Utilities Commission, has left that position to open an office in Chicago for engineering practice.

ESTHER F. YOUNG has been re-elected president of the Columbia Telephone Company, Columbia, Pa., at its annual meeting. Charles E. Taylor has been elected secretary-treasurer.

L. A. HERRICK, former manager of the Freeport Telephone Company, has become manager for the Mineral Point Telephone Company, Mineral Point, Wis., of which he is one of the stockholders.

THEODORE SWANN, general manager of sales, Alabama Power Company, Birmingham, Ala., has resigned. David H. Cronheim, heretofore assistant to Mr. Swann, has been appointed to succeed him.

R. J. STITTMATTER, formerly assistant sales manager for the Frantz-Premier Company, Cleveland, O., has joined the sales department of the Apex Electrical Distribution Company, manufacturer of Apex electric suction cleaners, Cleveland, Ohio.

HOMER E. NIESZ, secretary of the Budget and Expense Committee and Advisory Committee of the Commonwealth Edison Company, Chicago, has been assigned to take over the work handled by Major Junkersfeld during the latter's absence in active service. Major Junkersfeld was assistant to the vice-president. Mr. Niesz will continue to perform his former duties.

W. L. BARKER, electrical engineer of the Southern Utilities Company, having electric, gas and ice-making properties in Florida, has resigned to accept the position of electrical engineer of the Manila (P. I.) Electric Railroad & Light Company. Both of these companies are under direction of the J. G. White Management Corporation, of New York City. Before joining the organization of the Southern Utilities Company, Mr. Barker was connected with the staff of the General Electric Company. He is a graduate of the Alabama Polytechnic Institute.

ROBERT MONTGOMERY, manager of the commercial department of the Louisville Gas & Electric Company, Louisville, Ky., has passed the examination for admission to the next Officers Training Camp. He will go to Fort Benjamin Harrison on August 27, and during his absence his post will be held open for him. It is expected that T. B. Wilson, secretary of the company, will serve nominally as commercial manager, although the routine work of the department will be divided among some of the men in it. Mr. Montgomery failed to pass the physical test for the first camp, but a course of training sent him through the second time with flying colors.

D. ROY BLAICHER, purchasing agent for the Minneapolis General Electric Company and for all divisions of the Northern States Power Company, Minneapolis, has been called to Washington, D. C., to serve the Government as a member of the Board of Buyers. In that capacity Mr. Blaicher will have charge of all purchases of electrical equipment and apparatus for the numerous branches of Government work. Mr. Blaicher's experience has given him

D. Roy Blaicher.

wide acquaintance with the electrical line. He is 38 years of age, and a native of Hamilton, Ontario, Canada. Among the important positions held by him the following may be named: Purchasing agent for Baldwin Locomotive Company, Pittsburgh; in the service department of General Electric Company, Schenectady, N. Y.; he went to Toronto in 1907 to become purchasing agent for the Toronto Electric Light Company, and in 1912 the purchasing departments of the Toronto Street Railway Company and the Toronto Power Company came under his direction during a time when the properties of the three concerns were re-equipped. His connection with the Minneapolis General Electric Company, as purchasing agent, began in 1913, and during the last two years his duties have extended to a supervision of the buying of all material for the Northern States Power Company. Mr. Blaicher is a member of the Minneapolis Athletic Club, Minneapolis Civic and Commerce Association, and has been closely identified with N. E. L. A. activities. He is also treasurer of the Association of Edison Purchasing Agents.

O. LAURGAARD, engineer for a number of years in the construction of irrigaiton projects in the West, recently was appointed city engineer of Portland, Oregon.

WARREN I. LEE, Brooklyn, N. Y., former first deputy state comptroller, has been appointed assistant counsel to the New York State Public Service Commission.

J. L. STANNARD, Portland, Oregon, is consulting engineer in connection with the proposed hydroelectric plant for the city of Seattle. He has made plans and estimates covering all phases of the contemplated project.

E. L. WHITEHEAD has been appointed chief engineer for the Consumers' Power Company, with charge of the plant at Battle Creek, Michigan, succeeding T. M. Hooper. He formerly held a similar position with this company at Kalamazoo, where the position is now filled by A. Larkin, who was assistant to Mr. Whitehead for a number of years.

JOHN F. CARD, for the past 18 years superintendent and designing engineer of direct-current machinery for Fairbanks, Morse & Company at their Three Rivers, Mich., plant, has resigned to go into manufacturing business of his own account, having recently organized the Marble-Card Electric Company of Gladstone, Mich. Mr. Card has been in the electrical machinery manufacturing business for the past 25 years, having organized and designed the first line of machines for three well known concerns now in the business, besides superintending their construction for a number of years. The first line of machines were designed for the Triumph Electric Company of Cincinnati, Ohio, and Mr. Card superintended their construction for about one and one-half years when he was called to Mansfield, Ohio, to organize the Card Electric Company (now known as the Phoenix Electric Company) for the purpose of manufacturing a line of street-car motors and controllers, also multipolar motors and generators from 1 to 300 horsepower. After remaining with this company about five years Mr. Card took up his residence at Three Rivers, Mich., during the spring of 1899 and organized the Three Rivers Electric Company, then owned by the Sheffield Car Company but was later purchased by Fairbanks, Morse & Company of Chicago, Ill., and has been operated by them since that time, which was about 14 years ago. Mr. Card has had a wide and varied experience in the manufacture of direct-current machinery. He was born in Illinois, received his education at Covington, Ky., and began his business career with Card Electric Motor & Dynamo Company of Cincinnati, Ohio (now the Allis-Chalmers Company), and later taking charge of a large electrical repair shop after having been in the employ of the Cincinnati office of the General Electric Company for about one year in charge of the re testing and rebuilding of arc lamps.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

BOSTON, MASS.—The Revere Rubber Company will build a new one-story transformer house about 20x60 feet on Eastern Avenue, for plant operation, at an estimated cost of $10,000.

HARTFORD, CONN.—Hartford Electric Light Company is to build an addition to its plant.

BUFFALO, N. Y.—A one-story power house and electrical building 60x110 feet will be erected by the Pullman Company in connection with its new shops on Broadway.

BUFFALO, N. Y.—The International Railway Company, Ellicott Square Building, will build a new one-story electric substation, about 75x90 feet, on North Division Street.

LONG ISLAND CITY, N. Y.—The New York & Queens Electric Light, Heat & Power Company, 444 Jackson Avenue, will build a new two-story brick and steel electric substation in Lawrence Avenue, Flushing, to cost about $50,000.

NEW YORK, N. Y.—The New York Telephone Company is building a new two-story telephone exchange plant at 935 Hertle Avenue, Buffalo, to cost about $115,000.

NEW YORK, N. Y.—The New York Edison Company has awarded a contract for the construction of a one-story addition to its substation at 454 West Twenty-seventh Street, to cost about $35,000.

SHERMAN, N. Y.—The Public Service Commission has granted the village authorities permission to maintain and operate a municipal electric plant.

SYRACUSE, N. Y.—The Common Council has authorized a bond issue of $13,000 for the installation of new boilers in the City Hall.

TOMPKINSVILLE, N. Y.—Sealed bids will be received by the Light House Inspector until August 15 for furnishing four oil engine air compressor units.

DOVER, N. J.—The New Jersey Power & Light Company has completed the construction of a transmission line from its Mount Arlington station to Netcong, about five miles. The line will carry 11,000 volts, and will be used to supply the Stanhope-Netcong Company with electric energy for local distribution.

FLEMINGTON, N. J.—The Lambertville Public Service Company, Lambertville, has acquired the Flemington electric lighting plant, and is reported to be planning for extensions in the transmission line and system.

HOPEWELL, N. J.—The Public Service Electric Company is planning to improve the local street lighting system. Lamps of larger candle power will be placed at main street intersections.

MADISON, N. J.—The Board of Public Utility Commissioners has issued recommendations to the Borough Council to discontinue the sale of municipal light and power outside of the borough limits. Such non-residents now using the municipal light have filed a protest asking for a continuance of the service.

NEWARK, N. J.—The Beaver Engineering Company, 59 Mechanic Street, submitted a low bid to the Board of Freeholders for electrical work in the county penitentiary at Caldwell, at $3,474.

SOUTH ORANGE, N. J.—The South Orange Township Commission has completed the installation of a new police telegraph system. Extensions to the system are planned.

EASTON, PA.—The Pennsylvania Utilities Company has received a five-year contract from the Taylor-Wharton Iron & Steel Company for electric power for the operation of a new six-ton electric furnace and other purposes.

HARRISBURG, PA.—The city electrical department has commenced the installation of a new police and fire alarm telegraph system. New underground conduits will be installed to eliminate overhead lines in Court, Briggs, Cowden, and other streets.

HAZLETON, PA.—The Harwood Electric Company has received a contract from the Cranberry Creek Coal Company for furnishing power for the operation of a new breaker at Cranberry now nearing completion. This will be the first colliery in the local field to use electric energy for operation exclusively.

LANCASTER, PA.—The Lancaster General Hospital will build a new one-story brick boiler house, about 60x65 feet.

MARCUS HOOK, PA.—The Benzol Products Company has awarded contracts for the construction of a new main switch and transformer house at its works, to cost $10,000. F. W. Van Loon, 4 North Eleventh Street, Philadelphia, is the contractor.

MEDIA, PA.—The Philadelphia & West Chester Traction Company will extend its Collingdale line to the Sharon Hill section.

NORRISTOWN, PA.—The Western Union Telegraph Company has made application to the Public Service Commission for approval of contracts with Moreland, Cheltenham and Abington Townships for the construction of new underground conduit lines in various streets.

PENNSBURG, PA.—The Perkiomen Paper Company will build a new one-story boiler house addition at its plant.

PHILADELPHIA, PA.—Thomas Potters Sons Company, Second Street and Erie Avenue, will build a new one-story engine plant addition about 26x65 feet.

PHILADELPHIA, PA.—The Pennsylvania Railroad is taking bids up to August 14 for the construction of a new one-story concrete power house, 30x50 feet, at its Girard Point works.

PHILADELPHIA, PA.—Baugh & Sons, manufacturers of chemicals, will build a new one-story engine plant addition at their works on the Morris Street wharf.

PITTSBURGH, PA.—The National Biscuit Company has filed plans for the construction of a power house to cost $25,000 in connection with a new baking plant at Penn Avenue and Lambert Street. The entire factory will cost about $600,000.

TEMPLE, PA.—A one-story power house, about 65x81 feet, will be constructed by the Temple Malleable Iron & Steel Company in connection with a new foundry plant consisting of about nine buildings.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company, Lexington Street Building, is taking bids for its proposed new power house at Westport. The company is also building a one-story addition to its engine house No. 2, Spring Gardens, to cost $20,000.

BALTIMORE, MD.—The Goucher College, St. Paul Street, will build a new one-story brick and concrete power plant, about 40x64 feet, on Oak Street. Ellicott & Emmart, Union Trust Building, are engineers.

BALTIMORE, MD.—The Baltimore Dry Docks & Shipbuilding Company will build a new one-story power house, about 70x90 feet, at its works.

BALTIMORE, MD.—A company to be known as the Consolidated Power Company is being organized by the Consolidated Gas, Electric Light & Power Company, Lexington Street Building, to provide for improvements and extensions in electrical facilities. It is reported that a new generating plant will be erected with capacity of about 45,000 kilowatt.

PETERSBURG, VA.—The Petersburg, Hopewell & City Point Railway Company has been incorporated with a capital of $1,000,000 to acquire and improve the Petersburg & Appomattox Electric Railway. The specifications include the construction of eight miles of track. James C. Rees, Jr., is president.

MARTINSBURG, W. VA.—The Potomac Light & Power Company has commenced the erection of a new one-story hydroelectric power plant. The station is estimated to cost about $20,000.

MARTINSBURG, W. VA.—The Berkeley Woolen Mills is planning for the construction of a new central power plant for its works on Raleigh Street.

MAXTON, N. C.—The Town Commission will receive bids until August 15 for the installation of an electric lighting system.

ORIENTAL, N. C.—The town authorities are planning for the installation of an electric lighting plant.

ROXBORO, N. C.—The Little River Manufacturing Company is planning for the rebuilding of its power dam and other improvements in its power system.

SPARTANBURG, S. C.—J. B. Caldwell, Campobello, will install electric equipment for operation of his proposed new cottonseed oil mill.

ATLANTA, GA.—Georgia Railway & Power Company has applied for authority to issue and sell notes amounting to $2,500,000, the proceeds for use in building a reservoir, installing an additional generating unit in the Tallulah Falls power station, and the construction of a new power station two miles from the Tallula Falls plant. The estimated costs are as follows: New unit at Tallula, $330,000; new reservoir, $1,500,000; new generating station, $3,000,000; total, $4,830,000. The project will require about two years. The proposed development arises from great demands for hydroelectric power.

PALMETTO, GA.—Palmetto Cotton Mills will install electrical equipment.

DELAND, FLA.—A 30-year franchise has been voted to the Deland Electric Light & Power Company.

LEESBURG, FLA.—City will vote on the proposal to issue and sell bonds amounting to $40,000 for lighting plant and water works.

NORTH CENTRAL STATES.

LORAIN, O.—Lorain County Electric Company is having excavating done for a site on which to construct a central power station, to cost $1,500,000.

NEW BREMEN, O.—The New Bremen Telephone Company has increased its capital from $20,000 to $30,000.

FT. WAYNE, IND.—The Fort Wayne & Northern Indiana Traction Company is planning to erect an addition to its power house. Address S. W. Greenland, general manager, 310 West Main Street.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company has petitioned the Public Service Commission for authority to issue $1,000,000 in five-year 6 per cent notes to reimburse the treasurer of the company for expenditures already made for extensions and betterments and to pay for extensions.

BLOOMINGTON, ILL.—C. C. Williams, superintendent of water and light, has prepared plans for remodeling the plant. Specifications require two 500 and one 1,000-kilowatt-ampere, 2-phase, 60-cycle turbo-generator sets, with all accessory equipment; also material for 125 miles of distributing line; a 3,000-kilowatt transformer, 1,500 cedar poles, 4,000 Waltham meters. The cost of proposed improvements is estimated at $382,625.

EAST ST. LOUIS, ILL.—The St. Louis & East St. Louis Interurban Railway, recently incorporated by W. B. Tate, W.

P. Launtz, Clyde Allen, H. E. Meints and Joseph McCoy, desires to enter St. Louis with an Illinois interurban electric line and will do so if ground for a loop can be obtained in the latter city.

PALMYRA, ILL.—Palmyra Light, Heat & Power Company has been organized with capital of $10,000. The incorporators are Lewis King, C. W. King and Nellie G. King, of Palmyra. The plan is to produce electric power by steam-driven generator.

VIRDEN, ILL.—Macoupin County Telephone Company is installing its distributing wires in underground conduits.

ISHPEMING, MICH.—Bell Telephone Company is rebuilding its system on Menominee range, replacing old with modern equipment.

GRAND RAPIDS, MICH.—Northern Ohio Electric Corporation is to install one, and possibly two, 20,000-kilowatt turbo-generators. By this it is expected to reduce the percentage cost of operating.

BLACK EARTH, WIS.—The electric light plant is under construction, but completion is deferred by slow delivery of material. Substations are to be built at Cross Plains and Mt. Horeb, so the Black Earth service may be extended to those places.

FLORENCE, WIS.—The telephone system is being rebuilt. Lyman Green, superintendent of construction, will have a force of thirty men employed for several months. Cost of improvements outlined will amount to $50,000. Four new circuits are being put in, and several toll lines are to be strung along highways.

JANESVILLE, WIS.—Wisconsin Interurban Company is to build an electric line from Janesville to Madison. In the matter of financing the project, the company has filed at Madison a trust deed for $9,000,000, covering the property of the company along the proposed line. John T. Adams, Columbus, O., has taken a contract for constructing and equipping the road.

KENDALL, WIS.—The local telephone system has passed to the ownership of Leon J. Waters. Included in the deal is the building occupied by the exchange.

KOHLER, WIS.—Steps have been taken to establish electric street lights.

MADISON, WIS.—Wisconsin Interban has been given authority to issue $600,000 in bonds, the proceeds of which is to be used in building an electric railway from Portage to Madison. J. E. Jones, president, Portage, Wis.

MANITOWOC, WIS.—Manitowoc & Northern Traction Company has opened a station at Two Rivers.

MILWAUKEE, WIS.—John I. Beggs, former president of the Electric Railway Company, is one of the incorporators in the Western Engine & Dynamo Company, which filed articles of incorporation with the secretary of state. The capitalization is $200,000. Other incorporators are: C. B. Pierce, W. H. Cameron and J. H. Gugler.

MINERAL POINT, WIS.—Control of Mineral Point Telephone Company has been sold by E. L. Harman to L. A. Herrick and others. Mr. Herrick, who will be manager, formerly was manager for the Freeport Telephone Company.

MONTICELLO, WIS.—It is proposed to vote bonds amounting to $5,650 for lighting service.

WAUSAU, WIS.—Wisconsin Valley Electric Company is installing a new steam plant as accessory to existing plant on Plumer's Island. The cost is estimated at $90,000. New plant is to insure better and continuous service.

AITKIN, MINN.—A part of the Deerwood-Bay Lake telephone line has been sold by the Aitkin-Deerwood Telephone Company to the North Bay Lake Telephone Company. The line sold extends from Bay Lake to within two miles of Deerwood.

CEDAR RAPIDS, IA.—Franchise has been granted to the Iowa Falls Electric Company to erect transmission lines on certain roads and highways in Hamilton and Worth Counties.

DEEP RIVER, IA.—People's Gas & Electric Company has a franchise to install electric lights.

DES MOINES, IA.—The Iowa Telephone Company contemplates the installation of a telephone system to Camp Dodge.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Eleventh annual convention, Philadelphia, Pa., Bellevue-Stratford Hotel, September 10 to 14. Secretary, J. F. Kelly, National Tube Company, McKeesport, Pa.

Association of Railway Telegraph Superintendents. Annual convention, Hotel Raleigh, Washington, D. C., September 10 to 13. Secretary, W. L. Connelly, Gibson, Ind.

International Association of Municipal Electricians. Annual convention, Niagara Falls, N. Y., September 11 to 14. Secretary, Clarence R. George, Houston, Texas.

Northwest Section, National Electric Light Association. Annual convention, Spokane, Wash., September 12 to 15. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

American Electrochemical Society. Annual convention, Pittsburgh, Pa., October 3 to 6. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

National Electrical Contractors' Association of the United States. Annual convention, New Orleans, La., October 10 to 13. Secretary, H. C. Brown, Utica, N. Y.

McGREGOR, IA.—Mid-Continental Utilities, of Chicago, of which H. L. Clarke is president, has purchased the electric plant of the G. S. Donaldson Light & Power Company, at this place; and previously had purchased plants at Boscobel, Lancaster, Fennimore and Platteville, Wis. Mr. Clarke is president of the Fayette County Utilities, which owns the electric light plant at Oelwein, Iowa. The McGregor and Oelwein systems have been placed under one management, with Harry C. Cark of Oelwein in charge. It is understood the transmission line from Plattville to Lancaster will be extended to Prairie Du Chien.

NEVADA, IA.—Midwest Electrical Company, Omaha, has the contract for building an electric transmission line from Maxwell to Collins, and for building a substation at Collins.

BOWLING GREEN, MO.—The city's contract for street lighting has expired and until it is renewed no reconstruction work can be done. The new contract has not been granted as yet because of the fact that some members of the city council wish the current for street lights to be supplied over a meter.

CANTON, MO.—The city voted $10,000 bonds to improve the electric lights and water systems.

CARUTHERSVILLE, MO.—The telephone service is to be improved and additional equipment installed, according to Mr. Armstrong, district manager of the Southwestern Bell Telephone Company.

GOWER, MO.—The election for the issue of $93,000 in bonds to purchase an electric light plant carried.

KANSAS CITY, MO.—The Wyandotte County Commissioners will ask the Public Utilities Commission of Kansas to investigate the rates of the Standard Electric Light Company. Residents just across the line in Kansas and in Rosedale have filed many complaints of exorbitant rates for electricity.

MEMPHIS, MO.—By popular subscription four arc lights around the square are to be installed. If the municipal bonds are sold an electric light system will be installed later.

WARRENSBURG, MO.—The City Council has ratified the new lighting contract with the Warrensburg Light & Power Company, which is to continue five years. In the business section a White Way will be installed and 140 lights will be put in the residence districts in place of the old arc lights.

PARSONS, KANS.—The Southwestern Telephone Company has taken over the exchanges of the Citizens' Home Telephone Company, with equipment, at Parsons, Labette, Oswego, Altamont and Chetopa.

VLEITS, KANS.—The Vleits Northern Electric Company has been organized and a charter applied for by Wm. Johnson, H. H. Haskins and C. A. Kjellberg.

INDEPENDENCE, KANS.—A petition for a White Way has been generally signed by property owners and it is probable that lights will be established on principal streets.

FRIEND, NEB.—Bonds amounting to $10,000 were voted on at an election July 31. The funds sought to be raised are for an electric lighting system.

LINCOLN, NEB.—The Blair Telephone Company recently proposed to the Railway Commission to increase capital stock from $10,000 to $50,000 and borrow money to purchase the Bell company's competing plant. Additional data has been called for by the commission before acting on the proposal.

PETERSBURG, NEB.—The city contemplates the installation of an electric lighting system.

WESTERN, NEB.—Election was held July 31 to vote $10,000 bonds for an electric light system.

YORK, NEB.—The lighting system is to be improved and extended. This includes 235 street lamps.

ISABEL, S. D.—A building is being erected for city hall and electric light quarters. It is proposed to have the city buy material and wire the business and residence buildings.

SOUTH CENTRAL STATES.

HAZARD, KY.—The Kentucky River Power Company, having a power plant near Hazard, will shortly extend transmission lines into the Letcher County coal mining field and supply operations there.

LOUISVILLE, KY.—Work on the intake tunnel of the Louisville Gas & Electric Company, which leads from the bed of the Ohio River to the waterside plant of the company, is nearing completion. The work, begun nearly a year ago, will cost a million dollars by the time it is completed.

SERGENT, KY.—Whitley Elkhorn Coal Company will purchase electric coal-cutting machinery. J. M. Freeman is manager.

SERGENT, KY.—The Whitley-Elkhorn Coal Company is planning for the installation of a new electric generator and auxiliary equipment, and new electrically-operated coal machinery at its local properties. F. R. Rose is president.

SOMERSET, KY.—The Southern Machinery Exchange is in the market for a 5-horsepower, a. c., 220-volt motor.

FLORENCE, ALA.—Contract has been awarded to Central Construction Company, Indianapolis, Ind., by Mussle Shoals Traction Company, to construct electric railway between Florence and Huntsville, Ala., a distance of 64 miles, with branch to Lexington, Ala., distance of 12 miles. E. M. Wilkins, chief engineer, and M. S. Bingham, consulting engineer. Solon L. Whitten, Chicago, is president of Muscle Shoals Traction Co. and Tracey W. Pratt of Huntsville vice-president and treasurer.

CLARKSVILLE, ARK.—The City Council has awarded a contract to the Wesco Supply Company of St. Louis for the installation of a "white way" for Main Street, extending from the high school to the iron bridge. The work will be completed within 90 days.

MIAMI, OKLA.—The Neosho Power Company has been chartered with $500,000 capital stock by E. M. Stapleton, J. E. Parker and Henry E. Asp, of Oklahoma City.

WAYNOKA, OKLA.—A vote will be taken on proposal to issue bonds amounting to $26,000 to raise funds for an electric light and power plant.

WOODWARD, OKLA.—The mayor has been authorized to call a special bond election for $42,000 for making improvements in the light, water and sewage systems. About $32,000 will be used for extensions to the electric light plant.

ALVIN, TEX.—The Alvin Light & Ice Company has been chartered with a capital stock of $15,000 by C. A. Leavens, C. W. Marlin and W. M. Caley.

CLAUDE, TEX.—A. V. Wilson and O. F. Smalley will install additional machinery in electric plant.

SAN BENITO, TEX.—J. T. Lomax has purchased the electric light, water and telephone systems from a St. Louis corporation.

WESTERN STATES.

LEWISTON, UTAH.—An electric pumping plant for irrigation purposes

was installed on Bear River, five miles from Lewiston, which cost $25,000, and which will supply water for 30,000 acres of land. Current was turned on recently from the plant of Utah Power & Light Company.

SALT LAKE CITY, UTAH.—Mountain States Telephone & Telegraph Company is spending $15,000 reconstructing the old Independent telephone building, to relieve the pressure for room at its main building.

VIRGINIA CITY, NEV.—The Nevada Valleys Power Company has applied for a franchise to operate in Storey County, Nevada.

HAILEY, IDAHO.—Mountain States Telephone & Telegraph Company is putting up another two-wire circuit between Hailey and Hill City; and another line is to be built from Hailey to Shoshone.

ENTERPRISE, ORE.—The City Council has granted the Home Independent Telephone Company a ten-year franchise.

CHICO, CAL.—A new lighting system is to be established.

HANFORD, CAL.—A new system of electric lighting is to be established here.

INDEPENDENCE, CAL.—A telephone franchise for Inyo County has been granted to Frank Pelliser and E. S. Moore.

LOS ANGELES, CAL.—The Southern California Edison Company plans to expend $3,000,000 on its Big Creek hydroelectric plant and on a transmission line to Los Angeles.

LOS ANGELES, CAL.—Southern California Edison Company is authorized to issue bonds in the amount of $10,000,000. Part of proceeds will be spent on power plant, improvements and the extension of transmission lines.

MOJAVE, CAL.—A petition is being circulated here for an election to bond the town to install a street lighting system.

OAKLAND, CAL.—An ordinance forcing the Great Western Power Company to place its power lines underground within the limits of a zone to be fixed later was urged by Mayor John L. Davie in the City Council.

OROVILLE, CAL.—The Pacific Gas & Electric Company will spend about $50,000 for repairs on its plant in the next few months.

SAN FRANCISCO, CAL.—The Southern Sierras Power Company has asked the California Railroad Commission for authority to operate in San Bernardino, Riverside, Kern and Inyo counties.

SAN FRANCISCO, CAL.—The California Railroad Commission has authorized the Great Western Power Company to operate electrical transmission and distribution lines in Plumas County.

SAN FRANCISCO, CAL.—The Southwestern Home Telephone Company has filed an application with the California Railroad Commission to adjust its finances.

PROPOSALS

ELECTRICAL EQUIPMENT—Board of Public Works, Chicago, Frank T. Bennett, commissioner, will receive bids until Aug. 13, at room 406, City Hall, for furnishing and delivering at the Chicago Avenue pumping station, situated at 811 Lincoln Parkway, or to such other place as may be hereafter designated, two 1,100-horsepower synchronous motors, seven 400-kilovolt-ampere, single-phase transformers, according to plans on file in the office of the Department of Public Works, Chicago.

ELECTRIC LIGHTING SYSTEM—Bids will be received until Aug. 13 for electric lighting system for the structural shop at New York navy yard. Drawings and specifications may be obtained on application to F. R. Harris, Chief of Bureau, Washington, D. C., or to commandant at New York navy yard.

ELECTRIC LIGHTING EQUIPMENT—Sealed bids will be received at the office of the Board of Administration, at the state house, Topeka, Kansas, for the furnishing of electric lamps for the different institutions under the supervision of the Board of Administration, the State Board of Managers and Executive Council; bids to be filed until 2 p. m., Aug. 13. Contracts will be taken up for award at 2 p. m., Aug. 15. Said contract will be awarded upon the basis of $5,000 worth of lamps, delivered as ordered by the chief executive officer or superintendent of the institutions under the supervision of the Board of Administration, State Board Managers, Executive Council, or any other institution or department where lamps are purchased by the state. Incandescent lamps to be furnished under this contract shall be new lamps, and shall be guaranteed to be in accordance with the United States standard specifications as set forth in Circular No. 13, and from date of award until June 30, 1918. Bidders will make one price covering Mazda, as per price schedule of National Electric Lamp Association. Prices to include packing and packages, freight, delivered to the towns in which the institutions are located. A bill in detail must be sent to the institutions when the lamps are shipped. All proposals shall be in writing, sealed, and marked "Proposals for furnishing electric lamps," and shall be addressed to the Business Manager of the Board of Administration, Topeka, Kans. Certified check on some responsible bank payable to the Board of Administration, equal in amount of 5 per cent of amount of proposal. Each proposal shall be accompanied by a sample of the lamp proposed to be furnished, and original label must be left upon the same. Bidders must attach to each sample a card or tag on which must be plainly marked the name of the sender, the grade and the price of the lamps, and all charges must be prepaid. The Board will not be responsible for samples submitted. Jas. A. Kimball, business manager; Lee Harrison, secretary.

ELECTRICAL VACUUM CLEANERS—Sealed proposals will be received up to 3 p. m., Aug. 15, by Jas. A. Wetmore, acting supervising architect, Treasury Department, Washington, D. C., for supplying various public buildings, under control of Treasury Department, hand electric, portable vacuum cleaners during the fiscal year, ending June 30, 1918, in accordance with specifications, copies of which may be had in the discretion of the supervising architect.

FINANCIAL NOTES

The statement of earnings of the Coast Gas & Electric Company, San Francisco, for the six months ending June 30, 1917, shows that the company finished that period with a balance of $39,079 after paying bond interest and all other charges.

The California Railroad Commission has authorized the Southern California Edison Company to issue $1,978,000 face value of its general and refunding mortgage bonds to Harris Trust & Savings Bank of Chicago. The bonds are to be used to refund a like amount of two-year debentures of the Edison Company. This company has also been authorized to execute a mortgage or deed of trust to Harris Trust & Savings Bank and Los Angeles Trust & Savings Bank securing the payment of $136,000,000 face value of bonds.

Announcement has been made of the consummation of the taking over by the Lehigh Power Securities Corporation of the Lehigh Navigation Electric Company, the Lehigh Valley Transit Company and the companies formerly controlled by the Northern Central Company. The initial sale of notes will be $16,000,000, but an additional $4,000,000 may be subsequently sold, should the needs of the company's business require the expenditure. The Electric Bond & Share Company, which will manage the new company, feels that while construction costs are as high as at present, it is advisable to curtail the construction program so far as is consistent with public convenience, and the economical development of the business of the Lehigh Power Securities Corporation subsidiaries.

COPPER MARKET.

Copper prices have not changed perceptibly within the last week. August deliveries are quoted at 29.50 to 30 cents for lake copper and 28 to 28.50 cents for

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate per cent.	Bid July 31.	Bid Aug. 7.
Adirondack Electric Power of Glens Falls, common	..	18	18
Adirondack Electric Power of Glens Falls, preferred	6	72	72
American Gas & Electric of New York, common	10+extra	111	110
American Gas & Electric of New York, preferred	6	47½	47½
American Light & Traction of New York, common	..	300	295
American Light & Traction of New York, preferred	6	108	108
American Power & Light of New York, common	4	67	67
American Power & Light of New York, preferred	6	89½	87
American Public Utilities of Grand Rapids, common	..	28	27
American Public Utilities of Grand Rapids, preferred	6	64	64
American Telephone & Telegraph of New York	..	119	118½
American Water Works & Elec. of New York, common	..	7½	7
American Water Works & Elec. of New York, particip.	7	22	21
American Water Works & Elec. of New York, first preferred	..	67	67
Appalachian Power of Bluefield, common	..	4	4
Appalachian Power of Bluefield, preferred	7	30	30
Cities Service of New York, common	6+extra	274	274
Cities Service of New York, preferred	6	86¼	84½
Commonwealth Edison of Chicago	8	120½	120
Comm. Power, Railway & Light of Jackson, common	4	48	48
Comm. Power, Railway & Light of Jackson, preferred	6	76	76
Federal Light & Traction of New York, common	..	12	12½
Federal Light & Traction of New York, preferred	..	47	48
Illinois Northern Utilities of Dixon	6	78	75
Middle West Utilities of Chicago, common	2+2 extra	39	39
Middle West Utilities of Chicago, preferred	6	71	71
Northern States Power of Chicago, common	7	89	89
Northern States Power of Chicago, preferred	7	96½	97½
Pacific Gas & Electric of San Francisco, common	5	54	54
Pacific Gas & Electric of San Francisco, preferred	6	89½	88½
Public Service of Northern Illinois, Chicago, common	7	92	91
Public Service of Northern Illinois, Chicago, preferred	6	97	97
Republic Railway & Light of Youngstown, common	4	33	33¼
Republic Railway & Light of Youngstown, preferred	6	66	65½
Standard Gas & Electric of Chicago, common	..	10	10
Standard Gas & Electric of Chicago, preferred	6	35¼	35
Tennessee Railway, Light & Power of Chattanooga, common	..	5⅞	5¾
Tennessee Railway, Light & Power of Chattanooga, preferred	6	30	30
United Light & Railways of Grand Rapids, common	4	40	40
United Light & Railways of Grand Rapids, preferred	6	69	69½
Western Power of San Francisco, common	..	13½	13
Western Power of San Francisco, preferred	6	54	54
Western Union Telegraph of New York	extra	92¾	93
Industrials—			
Electric Storage Battery of Philadelphia, common	4	59½	59
General Electric of Schenectady	8	154	154½
National Carbon of Cleveland, common	8	79	*76
National Carbon of Cleveland, preferred	..	130¾	130¾
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	48½	49¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	65	65

* Last sale.

electrolytic. For September deliveries electrolytic are quoted at 27.75 to 28.25 cents, and slightly lower for October. Casting copper is quoted in New York at 28 to 28.50 cents and the supply is reported scarce.

Large consumers seem not to be active in the market, nor are producers figuring in the open market. The apathy, it is intimated, is due to the fact that the stocks of some of the large producers have been available to consumers who have taken big contracts requiring copper, and that demands have been supplied privately, while keeping the supply inaccessible to dealers. The recent purchases generally are estimated to have been far below consumption, which means that the heavy purchases early in the year still leaves many consumers well supplied. Some even found they had a surplus to sell, and those sales made outside the market tended to depress prices.

Meantime, copper production in Montana and Arizona has dropped materially by reason of shut-downs due to labor strikes. Anaconda Copper Company's July output was 8,000,000 pounds less than in June. Reports now indicate that with the suppression of I. W. W. disturbances in those states most of the miners are returning to work. The outlook is that mines, smelters and refineries, whose output had been either stopped or curtailed by strikes, will be operating at nearly full capacity by the close of this week.

Reports of Earnings.

NEW ORLEANS RAILWAY & LIGHT.

New Orleans Railway & Light Company reports earnings for six months ending June 30 as follows:

	1917.	1916.
Six months gross.....	$3,895,645	$3,594,643
Net after taxes.....	1,476,041	1,367,797
Surplus after charges.	*414,148	339,906

*This amount before distribution subject to a deduction of $16,666 per month, beginning June 1, 1916, and ending June 1, 1918, as an additional reserve for repairs, maintenance and renewals and replacements.

CHICAGO, NORTH SHORE & MILWAUKEE ELECTRIC.

Chicago, North Shore & Milwaukee Electric Railroad earnings for twelve months ended July 26 are as follows:

	1917.	1916.
Gross	$1,447,627	$1,102,817
Net after taxes.....	446,631	338,249
Other income	1,689	41,655
Surplus after charges.	448,321	379,904

CENTRAL STATES ELECTRIC CORPORATION.

The Cleveland Electric Illuminating Company, a subsidiary of Central States Electric Corporation, reports earnings for June and twelve months ended June 30, 1917, as follows:

	1917.	1916.
June gross.....$	510,468	$ 374,898
Net after taxes.....	177,488	172,160
Surplus after charges.	82,389	98,026
Twelve months gross.	5,840,883	4,649,339
Net after taxes.....	1,786,449	2,142,961
Surplus after charges.	679,684	1,145,894

INCORPORATIONS

STATESBORO, GA.—Eureka Telephone Company has been incorporated by L. M. Etheridge and associates.

ALVIN, TEX.—The Alvin Light & Ice Company has been incorporated with a capital for $15,000. C. A. Levenas.

HONAKER, VA.—The Honaker Light Company has been incorporated with a capital of $5,000. C. W. Hurt, president.

SPARLAND, ILL.—The Sparland Telephone Company has increased its capital stock from $2,000 to $10,000. C. R. Cheadle is secretary.

CHICAGO, ILL.—Double Life Storage Battery & Service Company, Chicago. Capital, $5,000. Incorporators: Ward S. Perry, J. F. Henning and E. J. Frietag.

BISMARCK, N. D.—The Aahby Light & Power Company, of New England, has been incorporated by C. H. Aaby, J. J. Murphy and W. L. Gardner, all of New England, for $25,000.

BRYAN, IND.—The Bryant Electric Company, Bryan, Ind. Capital, $10,000. Distribution and sale of electric current. Directors: Orville D. Arnold, James Rupel, Henry Huckreide, J. C. L. Whiteman, Irvin G. Metzner, Grover A. Smith.

CHICAGO, ILL.—Electrical Supply & Machinery Company, Chicago. Capital, $25,000. Incorporators: J. William Roulac, Henry Bluim, Donald S. McKinlay.

ALLIANCE, O.—The Alliance Armature & Motor Repair Company, Alliance. Capital, $10,000. Incorporators: William G. Richards, Henry R. Kline, Fred Ost, Kaspar Matthias and F. M. Matthias.

UNIONTOWN, KY.—Uniontown Telephone Company, Uniontown. Capital, $2,400. Incorporators: I. A. Dixon, W. C. Bland and J. W. Pfeffer.

SAN ANTONIO, TEX. — Charter amendment filed by Sowell Electric Company, San Antonio, changing name to Smylie-Oder Company.

INDIANAPOLIS, IND.—The Standard Electric Manufacturing Company, Indianapolis, increased its capital stock from $100,000 to $300,000.

BAYONNE, N. J.—Public Light Service Company. Capital, $25,000. To manufacture electric lamps and fixtures. Incorporators: Louis Lehr, Edward Sweeney, Murray Bell.

Electrical Patents Issued July 24 and 31, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,234,127. Automatically-Synchronized Entertainment Device. W. H. Bristol, assignor to Bristol Co., Waterbury, Conn. For operating a motion-picture machine. a sound reproducer and a piano-player.

1,234,130. Electrically-Driven Tire-Inflating Pump. B. S. Cartwright, Oelrichs, S. D. Structure of portable device.

1,234,134. Loud-Speaking Telephone System. J. J. Coner, assignor to Automatic Enunciator Co., Chicago, Ill. Arrangement of receiver circuits and amplifiers.

1,234,149. Electric Unit. F. M. Furber, assignor to United Shoe Machinery Co., Paterson, N. J. Resistance wire and terminal therefor both contain nickel.

1,234,151. Motor-Controller. M. M. Goldenstein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Special arrangement for starting and slowing down,

1,234,170. Synchronizing Apparatus. M. J. Johnson, assignor to Bristol Co., Waterbury, Conn. Arrangement comprising driving and driven devices each having field and armature and alternating source supplying equalizing currents.

1,234,185. Mine-Protection System. N. D. Levin, Columbus, Ohio. A mine closure device with a lock actuated electromagnetically and by atmosphere pressure.

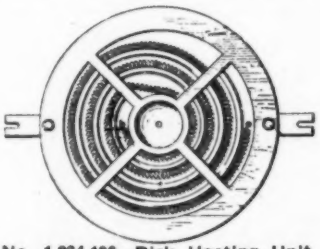
1,234,187. Telephone-Exchange System. A. E. Lundell, assignor to Western Electric Co., Inc., New York, N. Y. Details of system wherein an automatic switch is power driven under control of a sender.

1,234,192. Ignition-Dynamo. C. T. Mason, assignor to Splitdorf Electrical Co., Newark, N. J. Structure of magneto.

1,234,196. Heating-Coil Disk. M. Murphy, Janesville, Wis. For electric fireless cooker. (See cut.)

1,234,203. Pyrometer. E. F. Northrup, assignor to Pyroletric Instrument Co., Trenton, N. J. Special structure operating by metal expansion controls alarm circuit.

1,234,205. Strain-Insulator. D. H. Osborne, assignor to Locke Insulator Mfg. Co., Victor, N. Y. Details of construction.



No. 1,234,196—Disk Heating Unit.

1,234,211. Electric Switch. C. D. Platt, Bridgeport, Conn. Details of fused knife-blade structure with provision for preventing fingers coming in contact with live parts.

1,234,236. Trolley-Retriever. P. N. Van Epp, Medina, Ohio. Spring-driven structure for winding trolley rope.

1,234,237. Electric Contact Device. E. W. Vogel, assignor to Chicago Railway Signal and Supply Co., Carpentersville, Ill. Trolley-operated switch.

1,234,246. Telephone-Exchange System. J. L. Wright, assignor to Western Electric Co., Inc. Arrangement of automatic switch.

1,234,249. Signal. W. Zabel, Edgewood Borough, Pa. Electromagnetically operated street traffic signal.

1,234,261. Toy Electric Motor. F. C. Basinger, assignor of one-half to P. J. Bailey, Detroit, Mich. Details of construction.

1,234,271. Outlet-Box for Electric Conduits. W. A. Bonnell, Brooklyn, N. Y. Details of construction.

1,234,275. Contact Maker and Interrupter. W. C. Brinton, assignor to Philips-Brinton Co., Kennett Square, Pa. Structure of device for ignition systems.

1,234,278. Contact Maker and Interrupter for Ignition Systems. W. H. Brown and W. C. Brinton, Jr., assignors to Philips-Brinton Co. Structural details.

1,234,280. Electric Heating Device. F. C. E. Burnett and E. J. Brunning, Montreal, Quebec, Canada. Article to be heated forms the secondary of a transformer.

1,234,295. Automatic-Power-Controller. C. D. Curry, Brooklyn, N. Y. Machine requiring resetting at intervals has driving circuit broken if machine is not reset at predetermined interval.

1,234,301. Means for Controlling Electrical Energy. J. M. Dinkins, assignor to E. V. Hartford, Deal, N. J. Direction and duration of current flow controlled by an electromagnetic switch.

1,234,302. Arc-Lamp Condenser. J. L. Dinsmoor, Brooklyn, N. Y. For condensing the lamp gases.

1,234,313. Insulator. A. F. Effrig, Perkasie, Pa. Tieless pin-type.

1,234,329. Safety-Signal for Automobiles. R. Gardner and P. E. Krier, Indianapolis, Ind. Electromagnetically operated semaphore arm.

1,234,337. Electrical Device. G. A. Huber, New York, N. Y. Structure of vibratory bell.

1,234,354. Float-Controlled Circuit-Closer. S. E. Leming and C. C. Ellensberger, Island Heights, N. J. For tank alarm.

1,234,365. Welding-Machine. J. F. Makowski, assignor of one-half to C. Holoway, Jr., San Francisco, Cal. Has special rollers as electrodes.

1,234,395. Method of Forming Spark-Plugs. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Manner of forming gas-tight joint between insulator and electrode.

1,234,412. Push-Button Switch. A. K. Sutherland, assignor to Trumbull Electric Mfg. Co., Plainville, Conn. Details of two-push-button drop switch mechanism.

1,234,439. Rectifier. D. M. Bliss, assignor to T. A. Edison, Inc., West Orange, N. J. Commutating apparatus.

1,234,440. Alternating-Current Recti-

fier. D. M. Bliss, assignor to T. A. Edison, Inc. Contacts are operated by electromagnetic vibrator.

1,234,464. Electrical Instrument. C. I. Hall, assignor to General Electric Co., Schenectady, N. Y. An indicating instrument depending on balancing of direct and counter torques produced in a rotatable armature disk by induction motive device.

1,234,465. Electric Motor. C. I. Hall, assignor to General Electric Co. Modified motor for above having temperature compensating means.

1,234,466. Motor Device of the Induction Type. C. I. Hall, assignor to General Electric Co. Modification of No. 1,234,464.

1,234,471. Switchboard. J. P. Hayes, assignor of one-half to J. E. Barnhart, Pittsburgh, Pa. Detailed arrangement of bus bars and switches.

1,234,489. Process to Increase the Sensibility of Relays for Alternating Currents. E. Reisz, Berlin-Treptow, Germany. Special circuit arrangements including a gas discharge relay.

1,234,492. Electric-Railway Trolley. E. Rosenwinkel and L. Paperbrook, Addison, Ill. Pole has special bearing between relatively rotatable sections.

1,234,499. Electric Oven. E. L. Smalley, Montclair, N. J. A cylindrical resistance grill is mounted in grooves on the interior of a refractory cylinder.

1,234,500. Regulator. A. M. Smith, Fort Snelling, Minn. Furnace draft regulator is electromagnetically controlled by a thermostat.

1,234,504. Automatic-Setback Annunciator. L. Stephens, assignor of one-half to J. H. Greer, Fort Worth, Tex. Electromagnetically operated.

1,234,514. Electric Sign. H. W. Walden, New York, N. Y. Pattern plate operated switchboard.

1,234,515. Thermo-Electric Generator. H. W. Webb, Cresskill, N. J. Couples arranged in refractory compartment walls with outer cooling jacket and inner heater.

1,234,524. Quadruplex-Telegraph System. C. G. Ashley, assignor to General Enginering and Construction, Limited, Toronto, Ontario, Canada. The two potentials of an alternating current are segregated and manually interrupted separately to form separate codes.

1,234,534. Electric-Circuit-Controlling Device. J. Friis, assignor to T. Cusack Co., Chicago, Ill. Contact structure for flashers.

1,234,535. Signal Apparatus. A. Giacone, Brooklyn, N. Y. Contact apparatus wherein fingers make and break circuit with changes in their temperature.

1,234,542. Feed-Through Switch. G. H. Hart, West Hartford, Conn. Structure of push-button device.

1,234,544. Fuse-Block. D. C. Hooker, assignor to Johns-Pratt Co., Hartford, Conn. Construction of clips.

1,234,546. Safety-Indicator and License-Bracket. N. M. Johnson and T. S. Quin, Chicago, Ill. Has interiorly lighted rotatable cylinder.

1,234,550. Luminous Push-Button Attachment. C. H. Leube, Alameda, Cal. Cap for applying to push button.

1,234,570. Electric Cauterizer. L. G. Rink, assignor to Sharp & Smith, Chicago, Ill. Arrangement of resistor and terminals in device having removable cap.

1,234,583. Supporting Lengths of Wire. G. V. Twiss, assignor of one-half to Bullers, Limited, London, England. Clamp mounted on top of pin insulator.

1,234,584. Synchronism-Indicator. G. J. van Swaay and H. E. Keus, Hengelo, Netherlands. Electromagnetic vibrator comes to rest on synchronism and circuit breaker is operated on rise in voltage.

1,234,590. Lamp-Shade for Incandescent Lights. J. A. Whaley, New York, N. Y. Structure of collapsible device. (See cut.)

1,234,607. Light-Bracket. I. Berkowitz, New York, N. Y. For sewing machines.

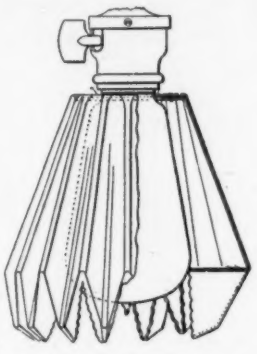
1,234,610. Automatic or Semi-Automatic Telephone-Exchange System. G. A. Betulander and N. G. Palmgren, London, England, said Palmgren assignor to said Betulander. Grouping of subscribers' lines and arrangement of junction and intermediate lines.

1,234,613. Telephone Instrument. G. Boissonnault, assignor to Micropho-Detector Co., Inc., New York, N. Y. Structure of microphone.

1,234,619. Massage-Vibrator. W. Broad, assignor of three-fourths to H. E. McLain, Pittsburgh, Pa. Details of device operated by electromagnet.

1,234,623. Telephone System. L. C. Bygrave, assignor to the Relay Automatic Telephone Co., Ltd., London, England. Arrangement of relay connectors.

1,234,644. Automatic Elevator. E. L. Dunn, assignor by mesne assignments to



No. 1,234,590—Lamp Shade.

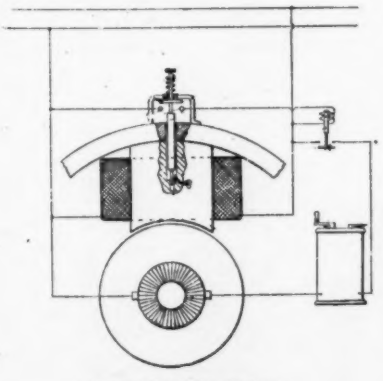
Standard Plunger Elevator Co., Worcester, Mass. Electrically controlled, hydraulically operated.

1,234,649. Telephone-Transmitter. J. P. Ferriter, assignor of one-half to T. J. Peters, Peters, Fla. Condenser with direct current across it has elements movable by diaphragm.

1,234,650. Buzzer-Transmitter. J. P. Ferriter, assignor of one-half to T. J. Peters, Peters, Fla. Structure of electromagnetic buzzer operating a microphone.

1,234,651. Telephone Talking-Coil and Circuit Connections. J. P. Ferriter, assignor of one-half to T. J. Peters, Peters, Fla. Arrangement of primary and secondary windings.

1,234,664. Crossing-Signal. W. A. Hesse and P. G. Sanborn, San Francisco,



No. 1,235,033—Relay.

Cal. Has swinging arm with lamps lighted or not according to position of arm.

1,234,670. Electric Heating Element. G. B. Jones, assignor to Globe Stove & Range Co., Kokomo, Ind. Structure of frame and mounting of resistor thereon.

1,234,673. Electric Spot-welding Apparatus. L. S. Lachman, assignor by mesne assignments to Thomson Spot Welder Co., Boston, Mass. Arrangement of two transformers to expend substantially all the energy at one working gap.

1,234,676. Engine-Starting System. L. Langner, assignor to Dayton Engineering Laboratories Co. Gearing of separate starting and ignition machines.

1,234,678. Electric Switch. J. F. Lincoln, assignor to Lincoln Electric Co., Cleveland, Ohio. Knife-blade switch with means for regulating its movement into extreme and intermediate positions.

1,234,691. Electric Incandescent Lamp with Gas Filling and a Holder for the Incandescent Wire. E. Podszus, Neukolln, Germany. Support is of boron nitrid.

1,234,700. Apparatus for Massage Treatment. H. E. McLain, assignor of one-fourth to W. Broad, Beaver Falls, Pa. Belt has number of magnetic vibrators which massage and heat the body.

Patents of July 31.

1,234,749. Push-button Switch. F. P. Gates, assignor to Arrow Electric Co., Hartford, Conn. Details of mechanism of two-push-button device.

1,234,750. Elevator Door. M. Gilmore, assignor to Variety Mfg. Co., Chicago, Ill. Arrangement for raising flexible shutter which is unlatched by elevator to permit it to descend.

1,234,757. Sparking Plug. A. E. Heath, London, England. Structural details.

1,234,763. Electrical Massage Apparatus. S. W. Hills, Jerome, Idaho. Construction of electromagnetic hand implement.

1,234,799. Capped Carbon Pencil. J. G. Peterson, assignor to Manhattan Electrical Supply Co., Jersey City, N. J. For dry cells.

1,234,811. Talking-machine Motor. W. G. Shelton, New York, N. Y. Details of gearing with record support.

1,234,824. Controlling Device. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. For a plurality of rheostats to be operated individually or collectively.

1,234,833. Electric-Lamp Support. J. W. Walter, Los Angeles, Cal. For attaching flashlight to handle of umbrella and the like.

1,234,836. Method and Apparatus for Electrically Reducing Refractory Substances. J. G. Webb, Richmond, Va. Structure of arc furnace and method of melting charge.

1,234,840. Binding-Post. E. F. Weston, assignor to Weston Electrical Instrument Co., Newark, N. J. Details of construction.

1,234,857. Electrical Connection and Box. C. H. Bissell and J. J. Dossert, assignors to Crouse-Hinds Co., Syracuse, N. Y. Structural details.

1,234,860. Portable Hand Instrument for Abdominal Massages. T. Bollin, Okmulgee, Okla. Has applicator comprising motor-rotated electrodes.

1,234,864 and 1,234,865. Electrical Regulator. H. W. Brown, assignor to Westinghouse Electric & Mfg. Co. Structures of contact devices for regulating turbo-alternators, etc.

1,234,866. Mica-building Machine. J. A. Burns, assignor to Westinghouse Electric & Mfg. Co. For making insulation.

1,234,875. Vapor Current Rectifying Device. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Structural details.

1,234,876. Electrical System. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Machine has armature windings variously connected to be driven by or to charge a battery.

1,234,901. Magneto-electric Machine. F. L. Hollister, London, England. Structure of device for ignition and lighting.

1,234,905. Process of Treating Nephelin Syenite. H. T. Kalmus, assignor to Exolon Co., Cambridge, Mass. Employs an electric furnace.

1,234,914. Dynamo-electric Machine. M. Latour, Paris, France. Arrangement of conductors in a homopolar dynamo.

1,234,916. Electric Regulating System. P. M. Lincoln, assignor to Westinghouse Electric & Mfg. Co. Number of generators with regulator for each have compensator for causing regulation of inductance according to resistance of circuit and number of generators in operation to maintain voltage at certain point of system.

1,234,922. Switch. J. J. E. Mattison, Pasadena, Cal. Structure of push-button device.

1,234,946. Electrode Packing for Melting Furnaces. M. Sperling, assignor to F. K. Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Details of fluid-cooled structure.

1,234,947. Cooled Bottom Electrode for Electric Smelting Furnaces. M. Sperling, assignor to F. K. Aktiengesellschaft. Structural details.

1,234,951. Globe for Electric-arc Lamps. T. Stave, assignor to Westinghouse Electric & Mfg. Co. Double-walled structure for flaming arc lamps.

1,234,964. Electrical Measuring Instrument. H. B. Taylor, assignor to Westinghouse Electric & Mfg. Co. Timed, electromagnetically-operated recording device.

1,234,970. Indicating Cycle-Meter. V. H. Todd, assignor to Westinghouse Electric & Mfg. Co. An indicator operating on excess voltage has its circuit broken on operation of excess current circuit breaker.

1,234,973. Electrical Heating Apparatus and Process of Making the Same. S. Trood, assignor to Westinghouse Electric & Mfg. Co. Heater has plug for lamp socket and comprises a resistor containing tungsten embedded in fused silica.

1,234,976. Electrical Measuring Instrument. T. W. Varley, assignor to Westinghouse Electric & Mfg. Co. Wattmeter has two-pole, permanent magnet with a pair of pole faces for each pole and a cylindrical armature with a four-pole winding and stationary means within the cylinder for shifting the flux from one pole face to another.

1,234,985. Case for Incandescent-electric Lamp Sockets. J. Weber, assignor to Weber Electric Co., Schenectady, N. Y. Manner of securing cap to shell.

1,234,991. Electrically-heated Cooking Stove. C. W. Winterbotham, Brighton Beach, Victoria, Australia. Arrangement of chambers and mounting of resistors.

1,234,993. Shade-Holder. R. K. Witz, assignor to Yost Electric Mfg. Co., Toledo, O. For attachment to lamp sockets.

1,234,999. Switching Device. W. M. Austin, assignor to Westinghouse Electric & Mfg. Co. Double throw, electromagnetically operated, switchboard structure.

1,235,005. Electric Apparatus for Bulletin-Boards, Signs, etc. M. J. Brown, Jersey City, N. J. Electromagnetic contact apparatus.

1,235,012. Electrical System. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Modification of No. 1,234,876.

1,235,020. Adjustable Shade-Holder. R. E. Ewing, assignor to Pittsburgh Lamp, Brass & Glass Co., Pittsburgh, Pa. For incandescent lamps.

1,235,028. Fire-detecting Wire. C. A. Harsch, assignor to W. H. Garrison, Brooklyn, N. Y. A perforated conductor with a fusible core is surrounded by permeable insulation and an exterior conductor.

1,235,033. Relay. H. D. James, assignor to Westinghouse Electric & Mfg. Co. Mounted on and operated by the flux of a pole of a dynamo electric machine. (See cut.)

1,235,046. Starting Mechanism for Gas-Engines. J. P. Nikonow, assignor to Westinghouse Electric & Mfg. Co. Gearing details of motor-generator.

1,235,058. Automatic Adjustable Headlight. E. E. Sanders, Chattanooga, Tenn. Is turned of electrically reciprocated armature.

1,235,061. Process of Producing an Insulating Material. W. Schewelin, Moscow, Russia. For treating fiber for insulating filling.

1,235,063. Electro-osmotic Process of Treating Liquid Mixtures. B. Schwerin, assignor to Elektro-Osmose Aktiengesellschaft, Frankfort-on-the-Main, Germany. For separating colloidal constituents of solutions containing electrolytes in undesired proportions.

1,235,064. Electro-osmotic Purification of Gelatinous Substances. B. Schwerin, assignor to Elektro-Osmose Aktiengesellschaft, Frankfort-on-the-Main, Germany. For separating and purifying constituents of an organic gelatinous substance.

1,235,065. Head-Lamp for Automobiles. G. E. Schweizer, Bridgeport, Conn. Structure of screening device.

1,235,069. Multiple Service Connection. T. Skinner, Lawrence, Kans. Details of device for connecting a number of wires.

1,235,077. Magneto Impulse Starter. J. R. Stark, Racine, Wis. Structural details.

1,235,081. Reactance-Coil. P. Torchio and H. R. Woodrow, assignors to T. E. Murray, New York, N. Y. Arrangement of "pancake" coils.

1,235,087. Electric-Motor Drive. J. E. White, Italy, Tex. Motor and brake automatically controlled by reciprocating member at end of its travel.

1,235,106. Insulator Attachment. A. C. Burnett, Youngstown, O. For securing a wire to the top of a pin insulator.

1,235,132. Electrical Motive Apparatus. R. H. Gaylord, Pasadena, and C. B. Capps, Los Angeles, Cal. Control of two induction motors mechanically connected to load.

1,235,149. Stamp-Mill. C. M. Mullen and R. E. Hall, Portland, Ore. Stamps are operated by electromagnets.

1,235,162. Engine-starting Motor. S. W. Rushmore, Plainfield, N. J. Axially-sliding armature to throw in and out of gear is automatically effected.

1,235,163. Engine-Starter. S. W. Rushmore, Plainfield, N. J. Modification of above.

1,235,178. Electrical Fuse. H. W. Young, Chicago, Ill. Structure of enclosed type.

1,235,184. Removable Eyelet for Passing Electric Conductors Through Rugs. B. G. Casbarian, Washington, D. C. Structural details.

1,235,186. Telephone-Exchange System. E. E. Clement, assignor to J. R. Garfield, trustee, Cleveland, O. Semi-automatic.

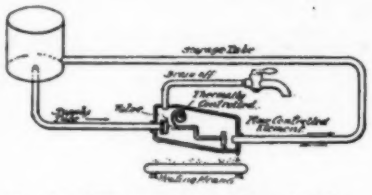
1,235,203. Electric Water-Heater. A. Herz and C. Herbst, Chicago, Ill. Relates to automatic control of fluid flow through electrically-heated tank. (See cut.)

1,235,204. Telephone-Transmitter. E. L. Holmes and E. Johnson, Jamestown, N. Y. Has special diaphragm deadener.

1,235,234. Electric Bell and Buzzer. H. G. Osborne, Brooklyn, N. Y. Structural details.

1,235,242. Fire-Alarm. P. Raymond, Maison-neuve, Quebec, Canada. Structure of electromagnetically controlled contact device.

1,235,244. Dimming Device for Regulating the Electric Lights of Automobiles. R. E. Reed, Ripon, Wis. Rheostat mounted on steering post.



No. 1,235,203—Electric Water Heater.

1,235,261. Time-controlled Switch for X-ray and Other Machines. H. F. Waite, Whitestone Landing, N. Y. Electromagnetically operated, dash-pot controlled.

1,235,271. Multiple Arc Lamp. M. J. Wohl, assignor to M. J. Wohl & Co., Brooklyn, N. Y. Relates to carbon feed.

1,235,272. Arc-Lamp and Reflector. M. J. Wohl, assignor to M. J. Wohl & Co. Angularly adjustable; for projectors.

1,235,274-5-6. Lamp. W. H. Wood, South Euclid, Ohio. Reflector structures for head lights and the like.

1,235,301. Measured-service Telephone System. J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. For automatic systems.

1,235,302. Telephone System. T. H. Ferguson, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Link-circuit arrangements.

1,235,340. Head-Lamp. B. Lewandowski, Tulare, Cal. Casing and reflector structure.

1,235,342. Process of and Apparatus for Manufacturing Prussic Acid. O. Liebknecht, assignor to Roessler & Hasslacher Chemical Co., New York, N. Y. Involves the submission of gaseous mixture of hydrogen, carbon and nitrogen to high voltage arc.

1,235,343. Process of Producing Prussic Acid. O. Liebknecht, assignor to Roessler & Hasslacher Chemical Co. Modification of above.

1,235,357. Ignition-Dynamo. C. T. Mason, assignor to Splitdorf Electrical Co., Newark, N. J. Relates to manner of excitation.

1,235,366. Spring Control for Electrical Measuring Instruments. E. P. Noyes, Fort Monroe, Va. Spring mechanism for needle of indicating instrument.

1,235,370. Protector for Dynamo-Belts. H. M. Patton, Atlanta, Ga. Housing for dynamo driving belt.

1,235,373. Protection of Electrical Apparatus. F. W. Peek, Jr., assignor to General Electric Co. Arrangement of winding to protect against abnormally high frequencies.

1,235,397. Electric Fitting. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Combined switch and attachment plug receptacle.

1,235,436. Regulation for Phase-Balancers. R. M. Carothers, assignor to General Electric Co. Excitation of balance is regulated in response to the ratio of an energy component of two phases.

1,235,474. Oculist's Instrument. J. Fredk. Herbert, Jr., Philadelphia, Pa. Special structure of tubular battery lamp.

1,235,484. Light-projecting Apparatus. R. E. Jones, Milwaukee, Wis. Combination of reflectors with adjustable lamp.

1,235,510. Microphone. E. M. Campbell, Tigerstedt, Copenhagen. Details of variable contact.

1,235,515. Combination-Lock. H. H. Chrisman, Minneapolis, Minn. Arrangement of contact disks and pins.

1,235,522. System and Method of Generating and Utilizing Electric Currents for Ignition and Battery-storing Purposes. L. J. Le Pontois, Cleveland, O. Arrangements for delivering unidirectional portion only of alternating current of magneto to battery and at the proper voltage.

1,235,524. Electric Welding Machine. R. C. Pierce, assignor to Thomson Electric Welding Co., Lynn, Mass. For butt welding pieces in desired angular relation.

1,235,531. Lamp-Socket Casing or the Like. C. J. Klein, Milwaukee, Wis. Manner of securing shell and cap.

Patents Expired.

The following United States electrical patents expired on August 7, 1917:

655,176. Electric Arc Lamp. J. F. Ackermann, New York, N. Y.

655,216. Switch for Suspended Electric Conductors. J. Floyd, Washington, D. C.

655,217. Crossing for Suspended Electrical Conductors. J. Floyd.

655,219. System of Electrical Distribution. E. E. Frischmuth, Berlin, Germany.

655,237. Apparatus for Transforming Alternating Currents into Continuous Currents and Vice-Versa. M. Hutin and M. Leblanc, Paris, France.

655,238. Process of Transforming Alternating Currents into Continuous Currents and Vice-Versa. M. Hutin and M. Leblanc.

655,239. Process of Bleaching by Electrolytic Chlorine Water. T. Jespersen, Neenah, Wis.

655,249. Telegraphic Typewriter. R. Kubler, Berlin, Germany.

655,265. Electric Cable. G. H. Nisbett, Hayton, England.

655,268. Electric Motor. E. G. P. Oelschlager, Charlottenburg, and C. O. F. Schrottke, Berlin, Germany.

655,276. Measuring Instrument. F. Schrottke, Berlin, Germany.

655,317. Electric Temperature Indicator. L. S. Wilder, Springfield, Mass.

655,335. Motor Starter. E. M. Fraser, San Francisco, Cal.

655,336. Controller. E. M. Fraser.

655,340. Starting Device for Electric Motors. J. H. F. Gorges, Berlin, Germany.

655,341. System of Alternating-Current Transmission. J. H. F. Gorges.

655,344. Cathode for Use in Electrolytic Cells. J. Hargreaves, Windes, England.

655,353. Meter. C. O. F. Schrottke, Berlin, Germany.

655,368. Electric Battery. C. E. O'Keenan, Faris, France.

655,389. Safety Device for Electric Vehicles. F. E. Case, Schenectady, N. Y.

655,411. Electrical Detector for Heat or Cold. J. O'Meara, New York, N. Y.